Metals Review

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TESTING AND INSPECTION ISSUE

Featuring

Testing and Inspection

By N. C. Fick

Research Engineer, Engineering Materials Div. Battelle Memorial Institute

A fundamental exposition of present methods and trends, with notes on the technical literature published during the past year (based on the "Review of Current Metal Literature").

Apparatus and Equipment *for Testing and Inspection*

A year's developments in mechanical testing machines and nondestructive inspection devices, as described by the manufacturers.

NOTABLE LECTURES

Reported This Month

V. E. Lysaght explains methods of microhardness testing, and application to metallurgical problems . . . Blake D. Mills, Jr., elaborates four reasons for making physical tests . . . James B. Austin tells how ferromagnetism is used in inspection and selection . . . Walter Crafts and A. B. Kinzel (in two lectures) emphasize importance of fully hardened martensitic structure and its relation to "serviceability factors" in selection of steel . . . Charles B. Bryant details failures of railroad materials and methods of detecting, avoiding, and remedying them.

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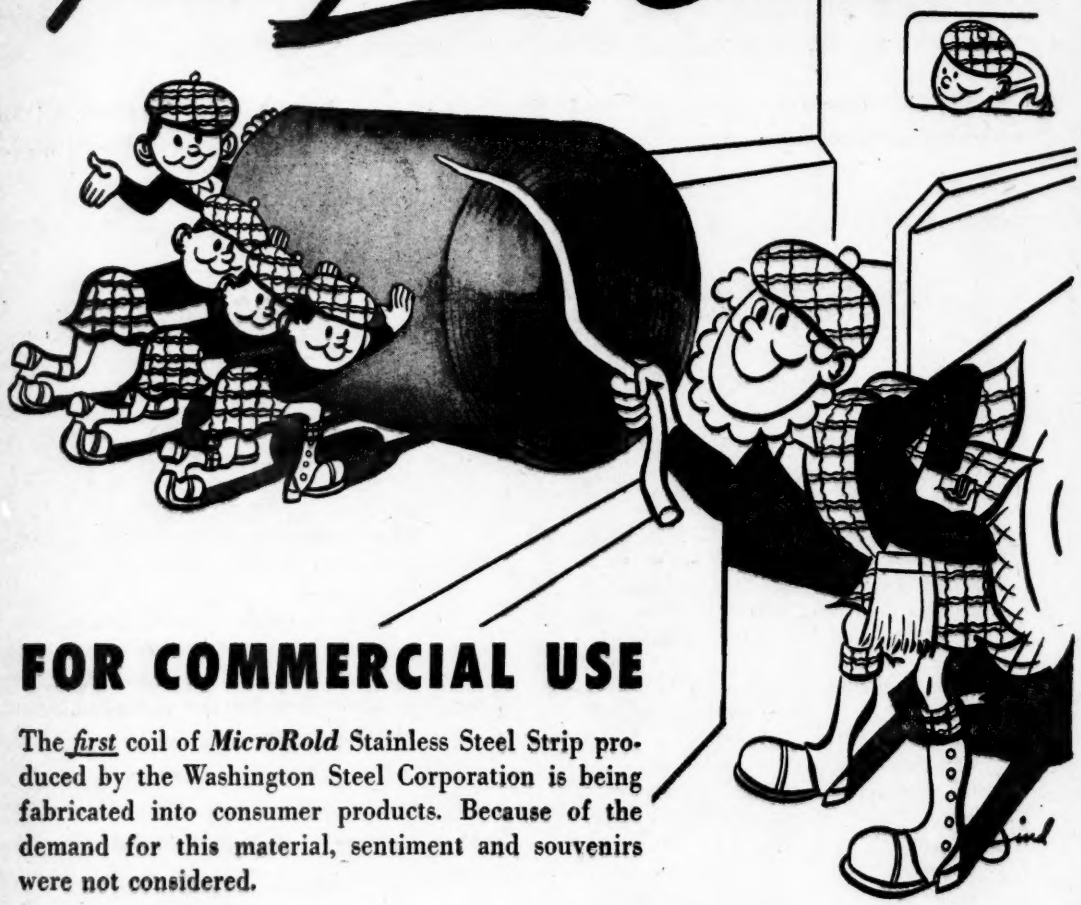

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Testing and Inspection

Present Methods and Trends, With Notes on the Literature

By N. C. Fick
Research Engineer, Engineering Materials Division
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MANY OF THE conventional materials tests are performed because they have become a tradition, rather than for the usable data they furnish. For this reason, it is extremely important that the metallurgist, testing engineer, and designer carefully analyze the requirements demanded of a metal for a given industrial application, and specify only the tests that are truly significant.

At the best, tests are expensive. Specifications should be as brief and as much to the point as possible. The manufacturer wants a material that will do a certain job satisfactorily. He may not specifically care about the chemistry, the Charpy notch toughness, the ductility, or the compressive strength, corrosion properties, fatigue life, or even whether it is ferrous or nonferrous, or a metal or nonmetal, as long as it performs well in service. The specifications must be drawn up on the basis of ultimate use; unnecessary extras come high. Will the part need high yield strength? Is it going to be subjected to repeated high tensile stresses? Will wear or corrosion be encountered? Will it have to resist high impact loads? What will be the temperature of operation? Answers to some of these questions will be clean-cut; others will require a certain amount of assumption and speculation.

Process control tests will have to be performed during manufacture to see that the metal continues to be satisfactory. Labor and metal must not be lost on faulty raw material that will finally be rejected after it has moved down a production line to the finished part.

Many tests have been standardized, in order to simplify specification of materials and to insure that tests of different lots or in different laboratories will be comparable. The American Society for Testing Materials, Society of Automotive Engineers, and American Standards Association have provided specifications relating to manufacture, fabrication, testing, and inspection of nearly every metal used in industry. The Army and Navy, other Federal agencies, and many individual producers and consumers have their own sets of specifications. But this has not entirely solved the problem. The standardized tests may give a general indication of performance, but the relation between standardized tests and actual performance is so variable that many special tests are still necessary.

Testing procedures can be divided into two categories—destructive and nondestructive. Among the more commonly performed destructive tests are hardness, tensile, fatigue, impact, bend, grain size, wear, corrosion, macro-etching and micro-etching. Literally thousands of machines have been built for destructive testing. Galileo, who died in 1642, is credited with devising some of the first testing machines to measure the strength of materials. Could Galileo but come back now, barely 300 years later, he would marvel at the complexity and accuracy of present-day testing machines. He would also marvel at the volume of accumulated testing data, and the fact that most of it is valueless (except for its historical significance), since so much of the work has been based on false assumptions.

Industrial requirements have forced improved techniques and closer adherence to scientific methods. We are constantly faced with the necessity for revising obsolete testing procedures, and reorganizing and bringing up to date the thought patterns and reservoirs of information and experiences on which interpretation of data must be based.

Yield Strength

Yield strength, or the stress at which a material exhibits a specified limiting permanent set, is a useful figure for the design of static structures, because it is a direct indication of load-carrying ability. The standard tensile specimen is a bar about 0.505 in. in diameter. In dealing with hardened test bars, the yield strength values obtained will truly represent heavier sections only when the heavier sections are also fully hardened.

There are two satisfactory methods for determining yield point (in metals that have one): (*a*) "the drop of the beam" method, and (*b*) the "total strain" method using dividers. In the first method the operator keeps the beam in balance by running out the poise at a steady rate while the load is being applied to the specimen at a steady rate of increase. The increase in load stops when the yield strength is reached, and the operator, who has been keeping the beam balanced, overshoots and the beam drops momentarily. Most machines are now equipped with a self-indicating load-measuring device. When the pointer stops, the load is observed and the corresponding stress is recorded as the yield strength.

In the second method a pair of dividers or an extensometer is used to observe the first visible stretch between two marks on the specimen. The stress corresponding to the load when stretch is first observed is the yield strength.

The yield point is the stress in a material at which a marked increase in strain occurs without an increase in stress. In most metals the stress-strain diagram in the region of the yield is a smooth gradual curve rather than a definite break. A technique that is particularly well adapted to determination of yield strength of these materials that do not have a definite yield point is found in the offset method. The specified permanent set is measured as a percentage of the original gage length and is laid off on the abscissa of the stress-strain diagram. A line is drawn parallel to the base of the stress-strain diagram to the point where it intersects the curve. When this point is projected to the ordinate, it gives the value of the yield strength. Offset is standardized at 0.2% for many materials, including alloy steel.

An approximate method frequently used for determining the yield strength without resorting to the stress-strain diagram is a "go no-go" test. This can be done on material whose stress-strain characteristics have been previously established on completed stress-strain charts drawn for almost identical material. The total strain required to give a specified permanent set is known within reasonable limits; therefore, the stress on the specimen when this total strain is applied is the approximate yield strength. The total strain is obtained by use of an extensometer reading to 0.0001 in. per in. of gage length.

Although tensile testing is widely used—second only to the hardness test—the details of testing and interpretation of results are debated subjects. Hollomon, in a discussion of tensile deformation, points out that, over a wide range of strains, the stress required for plastic flow varies with the strain to a small fractional power (9-91, 1945 volume*). Sachs and Lubahn report that the individual effects of triaxial-

*Literature references are designated by the corresponding item number in the Review of Current Metal Literature rather than by repeating the entire title, author and source; the reader can get this information by referring to *Metals Review* for the month indicated. "1945 volume" refers to Volume II, 1945, of the Review of Metal Literature, assembled and bound from the monthly installments.

ity, plastic strain, and stress concentration on the technical cohesive strength of steels can be separated from the combined effect by means of systematic notched-bar tensile tests with special attention given to such variables as notch radius, notch depth, and hardness (9-151, January 1946*).

Ductility

Elongation and reduction of area, which are by-products of the tensile test, are actually of little concern, except to furnish a rough approximation of the amount of plasticity in reserve to combat shattering fracture in event of an accident. Irregularities in composition or processing may be revealed to the metallurgist by ductility values. However, in deep drawing, the designer cannot rely on the ductility figures obtained in the laboratory to insure toughness of a sheet. In view of a lack of understanding and control of the affect of directional properties and other influencing factors, he must resort to a full-size test under the actual conditions of use. Unless steel is cross-rolled, it will have much lower ductility across than with the grain. A relatively new method for applying grids to sheet metal for measuring the distortion caused by stretch and flow during a forming or testing operation is accomplished by photography (9-132, 1945 volume).

Bend tests are used for wrought steels and welds. Flat, standard specimens are bent until failure of the outside fibers occurs. The amount of elongation of the outside fibers prior to failure is used as a measure of ductility. Using the conventional nick-bend test for weldability, Jackson and Luther have shown that ductility increases with increase in lapse of time between welding and testing (22-61, 1945 volume). Four factors listed as possible candidates to share responsibility for this gradual metallurgical change are *(a)* hydrogen, *(b)* aging, *(c)* retained austenite and *(d)* the relief of residual stresses.

Hardness

For practical purposes, hardness may be defined as resistance to penetration or, perhaps, resistance to abrasion. The Brinell, Rockwell, and Vickers machines have become almost as commonplace in the iron and steel industry as cupola and openhearth furnaces. Because of this general acceptance and the real utility of these machines, it is difficult to realize that they have not been perfected and that hardness research is still in order.

Generally speaking, the hardness test can be classed as destructive. The decarburized surface, rough scale, and other irregularities must be ground off the area in preparation for testing. However, the part may still be kept in the production line if this hardness impression is in an unstressed area.

The **Brinell** test consists of forcing a hardened steel ball, under a definite pressure, into the surface of the metal. The diameter of the imprint is used to calculate the hardness. The **Rockwell** test consists of forcing a hardened steel ball into the surface of relatively soft metals, or a diamond cone into the surface of the harder metals. Rockwell hardness measurement is not based on the total depth of penetration but upon the increment of depth due to an increment of load from a minor to a major value.

The **Vickers** hardness test consists of forcing, under predetermined load, a square-base diamond pyramid into the surface of the metal. The length of the diagonal of the square impression is used as a measure of hardness. The ratio of the impressed load to the area of the resulting indentation gives the hardness number. This machine was developed for testing extra hard metals. The **Knoop** hardness tester, which also has a diamond penetrator, offers a rapid means for testing the hardness of microscopic constituents in metals and alloys.

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The **scleroscope** hardness test depends on the drop and rebound of a diamond-tipped hammer. This is the same principle that permits soft ball bearings to be separated from hardened ball bearings merely by the difference in bouncing quality. The **monotron** hardness tester registers on a dial the load required to produce a definite distance of penetration of a diamond tip into a metal.

Scratch hardness methods such as the microcharacter are for the most part research tools. **File** hardness on the other hand is definitely a shop method.

Hardenability

Hardenability refers to the depth that a steel will harden in quenching. The only reason that an alloy steel has greater strength than a plain carbon steel is because it hardens to a greater depth. The presence of certain elements, such as manganese, has a decided influence on hardenability. A knowledge of the approximate chemistry of a heat of steel will, therefore, be of some help to guide the metallurgist. However, the final determination of hardenability is now generally made with the Jominy bar.

In this test a length of 1-in. round is quenched from one end by suspending the bar over a jet of water. When the bar is cool, part of the surface is removed from the side by grinding. Rockwell C impressions are taken at $\frac{1}{16}$ or $\frac{1}{8}$-in. intervals, starting at the fully quenched end. The distance that is covered from the quenched end without a definite drop in hardness is a measure of hardenability or depth of hardening.

Scrap steel for remelting is badly mixed and contaminated with every conceivable alloy. The presence of certain hardening elements such as molybdenum may be beneficial, detrimental, or wasteful, depending on the ultimate use. Work on N. E. steels during the war brought out the fact that certain combinations of residual elements are potent hardeners. Many steel mills have installed spectrographs for determining residual elements rapidly (10-39, May 1946). The fabricators are gradually getting away from the bad habit of ordering steel from the mill strictly on the basis of conventional chemical composition. If depth of hardening is the real problem to the manufacturer, then he should specify his steel on that basis rather than on a chemistry basis.

When properly interpreted by an experienced observer, information on spectrographic chemistry and hardenability taken on a test ingot at the openhearth can be used in allocating the heat to an order where it will most likely give satisfactory service. Grange and Garvey point out that the same austenizing temperature must be used for treating the test sample that is to be used in hardening the final product (9-25, April 1946).

A good practical way to show the presence or absence of adequate hardenability is to quench the steel in the desired shape, and measure the hardness over the cross section. The Shepherd fracture system has also been widely used for determining hardenability. It consists of fracturing a hardened piece and observing visually the depth of hard case in relation to the unhardened core.

Fatigue

Fatigue may be defined as the phenomenon of progressive fracture of a metal by means of a crack which spreads under repeated cycles of stress. The endurance limit is the maximum stress to which the metal may be subjected an infinitely large number of times without causing failure. The R. R. Moore type of machine for comparing materials under complete reversals of stress is perhaps the best known. An especially prepared round is cut down so that the location of failure will be confined to a very short gage length. The data obtained may be directly applicable to service providing the stress conditions are known to be the same.

The Krause type of testing machine is particularly adaptable to fatigue studies of flat sheet and plates. The

machine may be adjusted to give various combinations of stress ranging from pure tension through a combination of tension and compression to pure compression.

Fatigue is an important consideration in design. The uncertainty of the magnitude of stresses imposed on the structural members of an aircraft has forced the aircraft engineers to leave the realm of calculation and speculation. They have pasted electric strain gages on the surfaces in question and measured the stresses directly while the aircraft is in flight (24-111, August 1946, and 11-62, 1945 volume). The data obtained may call for a change in design, better materials, or both. The stresses so determined can be used for operating the fatigue testing machines in selecting better materials and improving design and construction.

Jackson and Grover have used the Krause-type machine to study notch sensitivity (9-53, July 1946) of magnesium alloy sheets, also lap joints formed by riveting, spot welding, cycle welding, and heliarc welding (9-52, July 1946). The fatigue life of a metal part that is to be operated at a specific stress level can be established with reasonable certainty. The effect of occasional or frequent overstressing on endurance life is not so well understood (9-85, 1945 volume).

Impact

The impact test consists of holding a small standard notched specimen 2.165 x 0.394 x 0.394 in. in dimension on an anvil and allowing it to be broken by a single blow from a moving mass (beam) of known kinetic energy. Ordinarily, the energy required to fracture the specimen is directly recorded on a dial in foot-pounds. Because of the apparent simplicity and the striking differences among steels and between specimens of certain steels tested at different temperature levels, this test method has been extensively used. The sad part of this test is the fact that, as more and more data are accumulated, it is becoming more and more apparent that there is no consistent correlation between the foot-pounds measured on the test specimen and the behavior of the steel in service.

Volumes of data on impact testing have been published. Two particularly thorough discussions are those of Gillett (3-198, 1945 volume) and Hollomon (9-113, 1945 volume). The lack of a clear understanding of impact phenomena has made attempts at correlation of impact data with other mechanical tests and with performance in service quite unreliable. The metallurgist in the steel mill can place steels in approximately the correct order to each other by noting the energy absorption figure and observing the nature of the fracture, but the designer can't rely on any impact data unless they be from full-scale testing under actual conditions of service.

Not long ago a large gas holder designed for use at very low temperature failed with disastrous results. It was lined with a high-nickel steel which had established a reputation for resistance to brittle fracture (Bureau of Mines Report of Investigations 3867, February 1946). The steel had been tested by the conventional impact methods and accepted on the basis of what was thought to be an adequate foot-pound energy absorption—still it failed. Obviously there was something wrong; something that was not revealed by testing.

Ship structures welded from steels which were considered to be of exellent quality on the basis of tests performed at both high and low temperatures have broken up with sudden, shattering, brittle failures. Much research has been aimed directly at the prevention of failure in ship plate (22-201, May 1946).

The influence of size is particularly spectacular in its effect on energy absorption. Small specimens will act tough and larger ones brittle for a given steel. Toughness can often be built into a part by using many thin sections of metal bolted, riveted, or wound together rather than a single, solid piece. Crane hooks and stranded cables are examples of this technique.

Creep

Creep testing involves the determination of the extension of metals due to the combined effects of temperature, tensile stress, and time. Creep testing is generally confined to the research laboratory, since it is inherently a long-time test requiring months or even years to obtain data on a single specimen. Time, temperature, and load are chosen on the basis of service requirements. For round specimens, the 0.505-in. diameter bar with at least a 2-in. gage length is recommended. The load is applied, often as dead weight, and is measured to within 1%. Close control and accurate determination of temperature are the most important considerations in creep testing, because a large change in creep rate may result from a small change in temperature in the higher ranges. Ordinarily, the test specimen is surrounded by a small furnace containing a window through which extension measurements can be taken at periodic intervals while the test is in progress.

"The Creep of Metals" was the subject of a conference called recently by Sir Charles Darwin in London. Experts discussed various aspects of the subject including a historical survey, the present position of experimental studies, the physical theory of creep, and the metallurgical control of creep (9-37, May 1946). One of the conclusions of particular interest to the engineer is the fact that it is still impossible to predict the creep behavior of a steel on the basis of other mechanical properties. Materials with exceedingly good high-temperature properties for the gas turbine and jet-propelled motor constitute a real challenge to the ingenuity of the metallurgist and the physicist. How can the rates of creep obtained on a specimen subjected to pure tension stresses in the laboratory be correlated to the rates of creep that will exist under the various complex stress conditions found in service?

Simulated Service Tests

There is a definite trend toward simulated service tests. The automobile companies have extensively adopted the proving-ground type of tests. These tests, though relatively expensive, are confidence builders and are particularly necessary when it is difficult to predetermine the magnitude, type, or distribution of stresses applied in service or when unknown temperatures and variable corrosive atmospheres or fluids are concerned.

The need for such costly simulated service tests can sometimes be eliminated by breaking down the service record into the true influence of the different factors. This is done by actually measuring the service stresses with strain gages, the operating temperatures with thermocouples, etc., and then evaluating materials on the basis of cheaper and well-controlled laboratory tests, considering each factor in its turn.

A manufacturer of household refrigerators devised a mechanical device to open and shut the door thousands of times a day. A few days of testing in this machine is comparable to years of service in the home. The manufacturer has thus obtained a practical check on design and material.

The railroads too have derived considerable benefit from simulated service tests. Kenyon has discussed thermal stresses in wrought steel wheels and a new improved wheel testing machine which has recently been developed (9-86, September 1946). In high-speed trains the chief problems are safety, and resistance to thermal cracking and to wear.

Destructive testing substantiated by metallographic examination is at present the most accurate and reliable way to determine the quality of a material or manufactured part. A thorough knowledge of test limitations, as well as service requirements and processing ranges, is a prerequisite for the men who are called on to draw up specifications.

Nondestructive Testing Methods

Among the nondestructive methods are found such tests as X-ray, fluoroscope, Magnaflux, Magnaglo, Zyglo, Cyclograph, and Reflectoscope. Also included under this heading would be visual inspection, spark testing, dimension gaging, and hundreds of special process control tests that have been developed to do a specific job.

LeGrand has prepared an excellent report on the principle of operation, uses, advantages, and limitations of the various nondestructive testing methods (12-95, July 1946). The five types of radiographic inspection used in process development and quality control are X-ray, gamma ray, fluoroscopy, photofluoroscopy, and X-ray diffraction.

Inspection

Aluminum and magnesium, because of the low atomic weights and ease of penetration, lend themselves particularly well to X-ray examination. Steel welds, castings, forgings, and assemblies, as well as plastic parts, are also inspected by X-ray. Among the defects or conditions that may be detected are porosity, shrinkage cracks, piping, blowholes, gas cavities, inclusions, bursts, and voids. The only product of the X-ray machine is a negative or shadow picture on which changes in density or thickness of the material X-rayed are revealed by light and dark areas. Interpretation of these light and dark areas is extremely important. Interpretation must be made on the basis of previous experience, the particular case history, and a thorough knowledge of basic requirements that must be met (12-51, April 1946).

The Allis-Chalmers Manufacturing Co. (12-191, January 1947) has introduced the 20 million volt betatron for industrial radiography. Speed with which radiographs can be made with this device is the primary advantage over one or two million volt X-ray equipment. The betatron has been successfully applied for inspection of material 20 in. thick. The maximum practical thickness has not been determined, but it is not considered practical for work less than 3 or 4 in. thick. Kerst, the inventor of the betatron, has come to the conclusion that the 20 million volt unit is the best size for industrial radiography, since smaller units lack needed penetrating power and sharp focus, and larger sizes become unwieldy and add little, if anything, to the utility.

Radiographic methods are often used to give final approval to a product before it is moved to the next step along the production line. Schneeman (12-164, November 1946) has emphasized the danger that lies in selecting a certain number of castings from a lot for inspection and assuming that they represent the entire lot. Certainly the ideal is 100% inspection, and this is particularly important if the parts in question are to be subjected to high stresses in service. Fluoroscopic and radiographic inspections can be combined effectively. Although the fluoroscope does not leave a permanent record, it is rapid and quite satisfactory for the thinner castings.

Fluoroscope

The fluoroscope is merely an X-ray apparatus with a fluorescent screen substituted for the film holder. A visual inspection is made of the shadow pattern (12-121, Sept. 1946). A new photofluorographic technique has recently been developed which provides a film record. A camera is used to take photographs of the image on the fluorescent screen (12-95, July 1946).

Gamma-Ray Testing

The gamma rays that are given off by the radium salts are sometimes used in place of X-rays. Although the penetrating power of the gamma ray is greater than that of the X-ray, the intensity of radiation is less and a longer exposure time is usually required. An overnight or over-the-weekend exposure is common. Chief advantage of gamma-ray inspection is a very small investment in equipment.

The Penetron has been developed to measure the wall thickness of pipe and tubing in an oil refinery, but can also be used on flat plates. A small quantity of radium salts is contained in a capsule attached to the end of a long cable. The back-scattered radiation from the gamma rays increases as a direct function of the wall thickness. These radiations are picked up by a detector. The current discharges are amplified, transmitted to a control box, and measured.

Aluminum, wood, and plastics, as well as iron and steel, can be inspected. Chief limitation is that the Penetron measures the average thickness over 1 sq.in., and will not identify local defects such as pinholes, corrosion pits, seams and fine cracks. It is slow, too, approximately 30 sec. being required to inspect 1 sq.in. of pipe.

Weber, in discussing drill pipe testing, points out that no instruments yet available will substitute for the basic visual examination of threads, joints, and shoulders (9-90, October 1946).

X-ray Diffraction

X-ray diffraction is being used to predict behavior of substances and to determine what has happened to a substance in preceding operations. The nature and performance of most substances are directly influenced by the crystalline structure. The atoms and molecules will have a certain arrangement if the structure is rolled, another if it is forged, and still another if heat treated. X-rays will diffract or bend when they are passed through a crystal, and the separation and intensities of the emergent rays are characteristic of the material. Exposure times required vary from 10 min. to 4 hr. (4-65, Sept. 1946).

L. R. Carr has discussed the quantitative interpretation of radiographs in terms of mechanical properties (12-188, December 1946). He strongly emphasizes that reliability of radiographic analysis depends upon extensive comparisons between radiographic and metallographic evidence. Localized defects are identified with certainty. General defects pose the main problem. He states that there is great need of some practical method of promoting a more universal standard for radiographic quality and consistency. This seems to be one of the most important developments ahead in radiography.

Magnetic Analysis

Most steel mills now have magnetic analysis installations for rapidly inspecting bars and tubing. One machine inspects material at speeds up to 100 ft. per min. The presence of cracks, seams, or laps is indicated by a meter. A second meter indicates any variations in heat treatment or chemistry. Magnaflux and Magnaglo are recognized for their ability to reveal cracks, blowholes, and inclusions on or near the surface. The materials must be magnetic.

Zyglo or fluorescent penetrant inspection may be used to reveal surface discontinuities in nonmagnetic materials such as aluminum, brass, bronze, austenitic stainless steels, and carbide. Zyglo is also adaptable to inspection of magnetic materials such as ball bearings where magnetization and handling are major problems.

Haber has described the testing procedure used by a railroad which has installed Magnaflux equipment in 26 of its shops (12-104, August 1946). Constant inspection is required to keep road failures and delays to a minimum. Some parts are tested when taken from the store stocks before assembling, and then periodically or whenever the opportunity presents itself thereafter. Among the parts tested are axles and axle gears, wheels, wheel seats, motor support bearing journals, roller bearing journals, fillets, pistons, traction motor armature shafts, pinions, ring gears, truck frames, crankshafts, camshafts, wristpins, blower drive shafts, connecting rods, connecting rod caps and bolts, equalizers, bolsters, spring hangers, swing hangers, and spring blanks.

The Civil Aeronautics Authority, as well as the Army and Navy, recognizes the importance of assembling only grade "A" materials in aircraft motors. Nearly all reciprocating and highly stressed parts of a light aircraft motor are subjected to either Magnaflux or Magnaglo test during a major overhaul. Some mechanics believe that they can detect with a high-power magnifying glass any defect that would be revealed by the Magnaflux or Magnaglo test. It stands to reason that a magnifying glass won't show up an imperfection that is below the surface and is about to become a serious stress raiser. Furthermore, to cover every inch of each part in a motor with a magnifying glass would take hours, whereas a better job can be done in a matter of minutes with magnetic particle methods.

Tests for surface imperfections such as cracks, inclusions, blowholes, and decarburization are important because they show the presence or absence of homogeneity between the surface and the interior of a piece. Calculations based on physical properties tests are often inaccurate because of inhomogeneity or the presence of stress raisers on the surface.

Other pieces of magnetic testing equipment, particularly adapted to sorting, are the Ferrograph and the Cyclograph. The usefulness of the Cyclograph for certain sorting operations has been described by Cavanagh (12-123, September 1946). Since the Cyclograph is a comparator, known standard parts must be used to set up the instrument. Mixed bolts made from two different steel compositions have been automatically sorted at the rate of 90 to 120 pieces per min. Fifty-

(Continued on page 47)

APPARATUS AND EQUIPMENT

for Testing and Inspection

A Year's Developments in Testing Devices, as Described by the Manufacturers

IMPROVED techniques in nondestructive testing methods for flaw detection and mechanical inspection reflect the war-born need for fast, accurate, quantity production. The year's developments in nondestructive testing and inspection—fruits still being harvested from wartime study—are therefore numerous and important. Nevertheless, several improvements and developments in equipment for the old standbys in the destructive testing field are noteworthy.

Tensile Tests

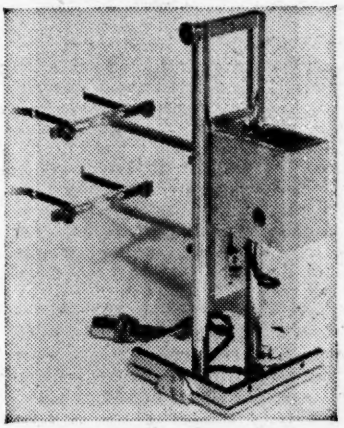
Universal testing machines with electronic variable speed motor drive—a wartime development by Tinius Olsen Testing Machine Co. (R-450)*—permit production testing with research accuracy. Constant loading speeds of 0 to 8 in. per min. are possible. Speeds are selected on a finger-tip control.

A similar wartime development was the Olsen electronic high magnification recorder (R-451), which greatly simplifies the making of accurate stress-strain curves in production testing. The recorder consists of an inductance bridge that has two coils, each with an established magnetic path interrupted by an air-gap. The inductance of each coil depends on size of the air-gap.

One of the air-gaps is actuated by the dimensional changes taking place in the material under test, while the other is actuated by a micrometer screw, driven by a motor, controlled by a vacuum tube amplifier which instantaneously responds to the electrical unbalance in the inductance bridge. The same motor is also geared to the recording drum and the entire system is synchronized. The bridge circuit controls both the direction and speed of rotation of the motor. Therefore, the measuring system is essentially a self-balancing null system, and the energy used to perform the recording is not derived from the specimen.

Simultaneously with the rotation of the drum, the autographic pen, actuated by the precise Olsen Pen-du-lever weighing system, moves across the chart and draws an accurate, highly magnified curve. Magnifications of strain of 500, 1000, or 2000 in. per in. of gage length are provided.

New instruments for making stress-strain curves in compression and flexure have now been developed for use



Olsen Compressometer

in conjunction with this recorder. They are known as the Olsen Compressometer for recording compression strains and the Flexometer for flexure or transverse tests (R-452). They can record crosshead travel or can be attached to compression specimens at definite gage lengths.

There are many different arrangements of these new instruments. Provision is made for rapid adjustment to specimens of different lengths, and the specimen attachments can be inserted in the instrument in a few seconds, with taper pins to lock them in place. These attachments can be secured directly to the specimen or they can be counterbalanced against the compression surfaces. Magnifications provided are 125, 250, 500, 1000 and 2000.

A low-range universal tester has been expressly built for lighter materials or small finished items by W. C. Dillon & Co., Inc. (R-453). It incorporates four separate capacities, each available instantly and shown individually on the large dial. These ranges are 0 to 10 lb. in 1-oz. dial divisions, 0 to 25 lb. in 2 oz., 0 to 50 lb. in 4 oz., and 0 to 100 lb. in 8 oz.

Its lower grip travel is continuously variable, or stepless, from 0 to 19 in. per min. It also has 0.5% accuracy, pendulum action, max-load reading, featherweight and swiveled upper grip, stroke-limiting switches, forward-reverse switch, elongation gage, and stress-strain recorder.

A new transverse tester, just announced by Steel City Testing Laboratory, is known as the Model TR-1 (R-454). It has a capacity up to 10,000 lb., is hydraulically operated, and is supplied with electric motor drive at voltages to suit the user's requirements. Load is applied automatically, at any desired speed. A specially constructed gage has a maximum-indicating hand that remains stationary when the specimen breaks. Gages may be calibrated in kilogram loads.

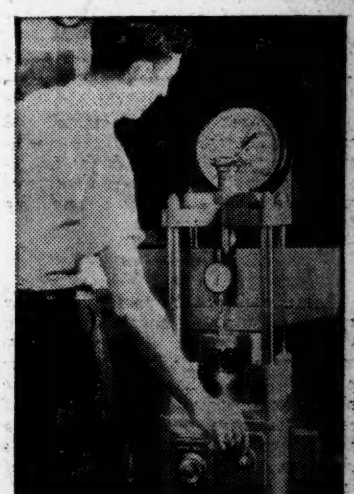
Steel City Testing Laboratory also introduced two new ductility testers during the past year—a Model PA-2 with a 15,000-lb. capacity for stock up to ⅛ in. in thickness, and a Model PA-3 with a 30,000-lb. capacity for stock up to ¼-in. thick (R-455).

In these machines the permanent head is piloted to the main cylinder body. This assures that the upper grip held in the head and the one mounted on the piston will always be completely concentric and the penetrator will start the cupping at the exact center of the opening in the grip. Another advantage of the multiple piston construction is that the specimen is automatically held between the grips with a load in proper proportion to the one being applied in forming the cup.

Cupping tools and dies are supplied to suit the various thicknesses of stock. A set of tools is supplied for easy removal of grips and penetrator.

Accurate yield strength determination without the necessity of plotting stress-strain curves is provided by a new slide-rule type of calculator developed by Case School of Applied Science, as part of a research program for Aluminum Research Institute (R-456).

The calculator gives tables and instructions for rapid yield strength determination of aluminum alloys, brass,



Transverse Tester Made by Steel City Testing Laboratory

*Further information about the products described may be secured by using the Reader Service Coupon on page 53 specifying the appropriate R-number, or by writing direct to the manufacturer at the address given on page 19.

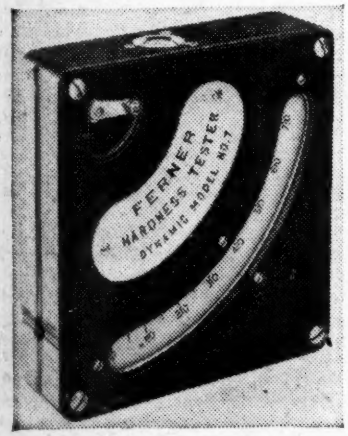
copper, carbon and low-alloy steels. Vertical movable columns of figures appear through fixed horizontal slots, enabling the operator to correlate diameter of test bar, sectional area, elongation, and yield load. Plotting of curves is unnecessary. Accuracy is on a par with that of other standard testing methods.

While physical testing of microspecimens is not new, it is only recently that R. Y. Ferner Co. has been licensed to produce the Chevenard Micromachine (originated by the noted French professor) in this country (R-457). The machine follows the conventional procedure in tensile, sheer and bending tests of metals, except that the force applied is very much less. The specimens, on the order of a few millimeters in size, can frequently be taken from the finished product without damage.

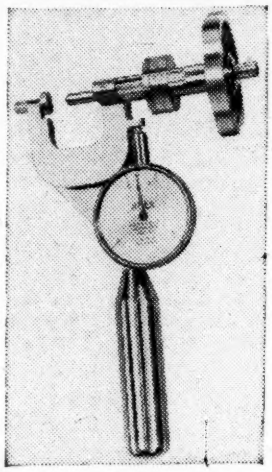
All testing is automatic after specimens are mounted. Results are disclosed directly on a photographic film or plate which is easily interpreted by the customary two-coordinate (stress-strain) pattern. A high order of accuracy and uniformity is assured. The machine is made in varying load capacities for various materials in the form of threads, sheets or rods, metal foils, ribbons or wires.

Announcement of the appointment of Adolph I. Buehler as exclusive agent for the United States and Canada for the Swiss-made Amsler testing equipment brings a new line of products to this firm. The majority of Amsler testing machines are of the universal tension and compression type, constructed mainly on the hydraulic principle. They include the Pendulum-Dynamometer—a highly accurate automatic load-weighing gage of the primary or absolute type—and the Hydraulic Pulsator which produces rapid fatigue stresses of high magnitude. Other machines are for universal testing, spring testing, combined fatigue testing, horizontal tensile testing, cold bend testing, ductility testing, and the high-frequency Vibrophore (R-458).

Three specialized testers that need be mentioned only briefly here are a tensile tester 25 ft. long (R-459) developed by John S. Barnes Corp. to determine the tensile strength or modulus of elasticity of finished metal products such as chains, wires, cables, and bar stock; a torsion testing machine developed by Sonntag Scientific Corp. and sold by Baldwin Locomotive Works (R-460) for testing bronze and copper trolley wire, telephone and telegraph wire and steel tie wire; and General Electric's two low-stress elongation testers (R-461) designed to measure the stiffness or springiness of copper wire.



Ferner Hardness Tester



Ames Portable Tester

Hardness Testing

Most recent new piece of equipment for hardness testing is a portable tester weighing only 2 lb. made by B. C. Ames Precision Machine Works (R-462). It utilizes the Rockwell penetration method. A diamond-point penetrator is used in testing hard materials in the Rockwell C-scale, and a ball-point penetrator is supplied for the B-scale. Screw pressure causes the frame to deflect, thereby moving the indicator pointer to dial markings for standard loads. Penetration is then read on the barrel dial, graduated in both Rockwell B and C-scales. The throat capacity is 1 in. Accessories include a V-shaped anvil, two test blocks and a Brinell conversion chart.

A Brinell machine for testing heavy and hard-to-handle specimens is being made by Steel City Testing Laboratory (R-463). It is known as Type A-4, and comes in two sizes—3 ft. 8 in. between standards for testing specimens 51 in. high, and 22 in. between standards for 24-in. specimens. A hardened steel base plate provides a solid foundation. It comes equipped with either standard Brinell microscope or direct-reading attachment.

A versatile Tukon hardness tester, known as the long-range Model LR, is recommended for both light and heavy load testing (R-464). It is manufactured by Wilson Mechanical Instrument Co., and applies loads of 25 to 50,000 g. It is designed for testing with either the Knoop or 136° diamond pyramid indenter (Vickers type). Features include a high-speed elevating screw for adjustment to specimen thickness and a meter indicating completion of test cycle. Loads of 10,000 g. are furnished as standard equipment.

U. S. Steel Corp. Research Laboratories have recently devised a microhardness tester which will measure hardness gradients within extremely small areas (R-465). The device consists of the indenter with a square-base, 136° diamond pyramid penetrator, the mechanical stage for holding the specimen, a microscope capable of magnifying the test field 500 to 1500 times, and a control box. All parts are assembled on a heavy cast iron plate supported by steel legs which rest on insulated wooden blocks to minimize effects of vibrations present in the building. As many as 60 indentations may be made automatically at predetermined time and space intervals.

R. Y. Ferner Co.'s dynamic hardness tester No. 7 (R-466) is a pocket-size instrument using a pendulum hammer. The instrument is simply held against the piece to be tested and the hammer released; a pointer indicates height of rebound, which can be converted to scleroscope, Brinell or Rockwell hardness numbers. Pieces too large for the usual hardness machines can be tested with this instrument, as well as irregular shapes and metals as thin as 0.002 in.

A recent accessory for this instrument is a "universalizing attachment" permitting its use close to shoulders, in recesses, or on small, hollow or wedge-shaped specimens. The attachment consists of a striking pin held by spring tension against the test piece. The falling pendulum hammer strikes against the rear end of the striking pin, and the energy of rebound is transmitted through the pin. A modified scale for use with this device is also supplied.

To determine variations in hardness, two new hardness gages have been added to the line manufactured by R. A. Webster (R-467). These gages are small, portable instruments designed to distinguish heat treated materials from those which have not been heat treated, to recognize parts made from an improper or substandard alloy, to differentiate between soft and workhardened materials, to test for proper response to heat treatment and to segregate material in stock.

They are operated by compressing the handles, which actuate the penetrator. Model B, which provides a dial reading from 1 to 20, is for direct hardness readings on aluminum alloys, and Model B-75 is for brass and other nonferrous metals. The anvil design permits tests upon stock of any shape.

Fatigue Testing

Developed to test actual gas turbine buckets that cannot be accurately evaluated from standard test specimens, a pneumatic fatigue machine made by General Electric Co. (R-468) can be used for other small assemblies

G. E. Pneumatic Fatigue Machine

and for test specimens as well. It uses a pneumatic resonant principle and tests specimens and parts by reverse bending. By vibrating the specimen at its own resonant frequency, the test machine closely simulates the actual dynamic loading conditions.

An opposed cylinder-type driving mechanism vibrates the specimen. The latter is positioned so that when small light-weight pistons are attached to it, the pistons are located between the openings of the two opposed air cylinders. Pressure impulses from the cylinders vibrate the specimen. By adjusting the driving mechanism until the frequency of the pressure impulses is the same as the natural frequency of the specimen, highest displacement of vibration is obtained. The machine will continue to vibrate the specimen until failure occurs.

A microscope and vibrating-type reed frequency meters are furnished as standard equipment with a fatigue motor for direct reading of displacement and frequency. An optional accessory panel providing recording and direct reading of the displacement, frequency, and temperature of the specimen, as well as automatic shutdown upon failure of the specimen, can be added at any time. A furnace which permits testing at temperatures up to 1700° F. is also offered as optional equipment.

Two new fatigue testers announced by Baldwin Locomotive Works since the first of the year are the Sonntag SF-2 and the Sonntag SF-4 machines. The SF-4 (R-469) is equipped for tension-compression testing both at ambient and at high temperatures. Constant load is automatically maintained through the entire period of test, and no recalibration is needed while the test is in progress.

Maximum capacity of this machine in either direction is 10,000 lb., and speed of testing is 3600 load cycles per min. Weight of the machine is 3000 lb.

The dynamic load is applied by a revolving mass, off center. The eccentric is of the micrometer screw type, permitting fine adjustments quickly by hand, and its amount is read like a micrometer. The entire working mechanism is seismically suspended on soft tension springs which absorb over 99% of the vibratory forces. Dynamic load remains constant and over-all variations are less than ± 2%.

The Sonntag Model SF-2 (R-470) is a bench-type fatigue machine with "constant-force" loading feature. It uses a revolving eccentric mass as a means of loading, avoiding cams or eccentric connecting rods which require readjustment during the test as the stiffness of the specimen changes. Thus the load automatically remains constant regardless of changes in the amount of deflection of the specimen. A predetermined load is alternately applied, and the resulting deflection is incidental.

In this simulated service equipment the specimen undergoes the same stresses the material would sustain in actual use and the point of failure is accurately determined. Because of its comparatively small size, the SF-2 can be placed in a cabinet during a test so that temperature and humidity can be controlled. The machine weighs 115 lb., has an alternating force capacity of 20 lb. and a speed of 1800 cycles per min. with a total travel of the loading yoke of 1 in. per cycle.

Creep Testing

Baldwin Locomotive Works also has available a creep testing machine of the lever-arm type (R-471). Capacity is 12,000 lb. (60,000 psi. on 0.505-in. specimen). Accuracy guaranteed is within 1% of load.

Strain indication is by extensometer attached at pinholes at the shoulders of the specimen and is read directly to 0.000025 in. on a motor-driven revolution counter by means of a follow-up contact method. The extensometer will operate to rupture. Accuracy of the strain unit is close to 0.00005 in.

The specimen is heated by a small furnace with coils wound with chromel wire arranged in three banks to provide temperature adjustment in top, middle and bottom zones by rheostats. Maximum temperature for the furnace that is furnished as standard equipment is 1600° F. Furnaces for 1800 and 2200° F. can also be supplied. Maximum possible elongation of the specimen is 1¾ in.

A screw-driven creep-rupture testing machine developed by Westinghouse Research Laboratories (R-472) incorporates in its design a number of time-saving and space-saving features. It uses no weights, requires no extensometer, and automatically draws a creep curve.

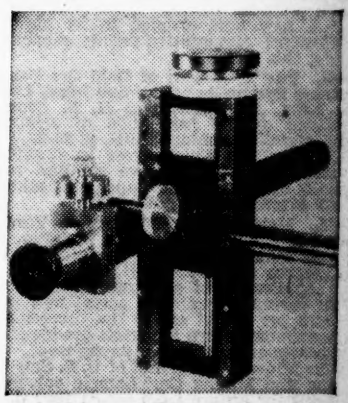
Lever arms and weights are eliminated by the use of a motor-driven screw jack which loads the specimen through a stiff spring, or force-measuring bar, in series with it. This innovation in design not only frees the operator from manipulating large numbers of weights, but also limits the floor space occupied by a 10-ton machine to an economical 15x15 in. A machine of these dimensions is capable of exerting a sustained stress of 100,000 psi. on a standard 0.505-in. specimen.

Instead of an extensometer, creep is measured by the travel of the screw jack in maintaining constant load on the test piece. The deflection of the force-measuring bar at any time is indicated by a dial gage mounted upon it. An electrical contact on the dial controls the operation of the motor. Automatic recording equipment traces an individual creep curve for each test, disposing of the need for taking strain gage readings every few minutes. The machine can readily be adapted for short-time tensile tests, constant strain-rate tests, or relaxation tests.

Three new instruments for use with creep testing assemblies have been introduced by Gaertner Scientific Corp. A single filar micrometer microscope (R-473) mounted on a micrometer slide is especially adapted for use with creep testing furnaces. It is equipped with relay lenses to provide greater working distance where thick furnace walls or other factors make the specimen somewhat inaccessible. It reads directly to 0.00001 in.

In another instrument for measuring horizontal displacements (R-474) two filar eyepiece micrometers are mounted in telescopes to give long working distances with moderate magnification. The separation between optical axes is fixed. Vertical positioning is by rack and pinion elevating stand.

The third instrument is an extensometer designed with an exceptionally long working distance and equipped with an internal illuminator built into the optical system (R-475). Relay lenses give working distance of 130 mm. and magnification of 100×. It is calibrated to read 0.0005 mm. per division of the filar eyepiece micrometer drum.



Single Filar Micrometer Microscope Mounted on a Micrometer Slide

A vacuum creep furnace (R-476) has been especially designed by Sylvania Electric Products, Inc., for high-temperature measurements on tungsten and alloy wires used in radio tube and lamp filaments. Four specimens, each with a suspended weight, are subjected to varying temperature cycles. Elongation is measured by four micrometers at the bottom of the furnace tube. A Pirani gage indicates degree of vacuum. Minute amounts of creep can be measured in fine filaments that must operate at high temperatures and frequently under tension in bulbs with outside diameters as small as ⅛ in.

(Turn to page 14)

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad, Received in the Library of Battelle Memorial Institute, Columbus, Ohio, During the Past Month

1 ORES & RAW MATERIALS Production; Beneficiation

1-40. Beneficiation of New England Beryllium Ores. Frank D. Lamb. *Bureau of Mines Report of Investigations 4040*, March 1947, 9 p.

Three beryl-bearing ores from the New England States were tested. The ores were found amenable to flotation only after desliming and vigorous surface conditioning with a suitable agent, such as caustic soda, trisodium phosphate, or hydrofluoric acid. Fatty acids emulsified with Emulsol X-1 were found to be the most satisfactory promoting agents.

1-41. The H.H. Sink and Float Process of Mineral Separation. H. W. Halton. *Western Miner*, v. 20, March 1947, p. 52, 54.

Process uses a stable suspension of fine solids in water as the separating medium. Criteria of suitability of the process for different ores.

1-42. Crushing and Grinding Efficiencies. S. R. Rabson. *Journal of the Chemical, Metallurgical and Mining Society of South Africa*, v. 47, Dec. 1946, p. 235-237.

Discussion of paper by T. K. Prentice in Jan-Feb. 1946 issue.

1-43. En ny Flotationsapparat för Laboratorieändamal. (A New Flotation Apparatus for Laboratory Use.) T. Mörtsell. *Jernkontorets Annaler*, v. 131, no. 1, 1947, p. 26-28.

A new unit claimed to be highly efficient; comparative results supporting this claim.

1-44. The Treatment of Gold Ore Containing Pyrrhotite at the Sub Nigel, Ltd. A. King, A. Clemes and H. E. Cross. *Bulletin of the Institution of Mining and Metallurgy*, March 1947, p. 25-33.

Difficulties which arose in cyanide treatment of the above ore and results of investigations and steps taken to overcome the difficulties.

1-45. Metallurgical Efficiency—a Yardstick in Lead-Zinc Flotation Metallurgy. R. A. Pallanch. *Mining Technology*, v. 11, March 1947, T. P. 2141, 5 p.

Application of a "yardstick" defined as percentage ratio of actual mill return per ton of ore to the theoretical maximum return if perfect grades and recoveries had been accomplished, at the Midvale, Utah, mill of U. S. Smelting and Mining Co. Sample calculations for an ore from which four different metals are recovered.

1-46. Crushing Practice at the Braden Copper Co. E. R. Johnson. *Mining Technology*, v. 11, March 1947, T. P. 2150, 7 p.

Numerous improvements made in the crushing section of a large copper flotation concentrator in Chile during the past 15 years to increase the efficiency and to raise daily output from around 20,000 to 30,000 tons.

1-47. Tailings and Mine-Dump Reclamation in the Coeur d'Alenes During World War II. W. L. Zeigler. *Mining Technology*, v. 11, March 1947, T. P. 2145, 10 p.

Methods used for recovery of lead and zinc concentrates.

1-48. Roasting and Flotation Practice in the Lake Shore Mines Sulphide Treatment Plant. J. E. Williamson, A. L. Blomfield and B. S. Crocker. *Transactions of the Canadian Institute of Mining and Metallurgy*, v. 50, 1947, p. 138-200. (Bound with *Canadian Mining and Metallurgical Bulletin*, March 1947.)

Extensive description of Canadian gold recovery plant. The introduction describes the distribution of values in the ore, and the reasons for deciding upon certain equipment, procedures, and sequences in the treating plant. Part I gives a detailed description of the flotation plant; Part II, the roasting plant; and Part III, the cyanidation plant. The appendix describes assay and other laboratory techniques, and gives information concerning costs. 13 ref.

1-49. An Occurrence of Submicroscopic Gold in the Dolphin East Lode, Fiji. F. L. Stillwell and A. B. Edwards. *Australasian Institute of Mining & Metallurgy Proceedings*, March 31, 1946, p. 31-46.

Micrographs of pyrite and arsenopyrite ores containing "invisible gold" in amounts of 25 to 35 oz. per ton; the ore is described.

1-50. Arizona's Mardun Uses Dry Concentration. *Mining World*, v. 9, April 1947, p. 27-28.

Mining and beneficiation of copper deposit which consists of minus 200-mesh carbonates occurring as a coating and cementing material between the grains of sandstone. The rock is crushed and ground to liberate the constituents, which are then separated in a special air separator. The liberation is accomplished with very little reduction in size of the sand grains.

1-51. Remote Control a Feature of Ore-Conditioning Plant. A. A. Nilsen and Roy Yingling. *Engineering and Mining Journal*, v. 148, April 1947, p. 74-79.

Large central plant of Tennessee Coal, Iron & Railroad Co., in the Birmingham district, prepares ores from its different mines for its furnaces by crushing, screening, and blending. Withdrawal of ore from 40 800-ton storage silos is directed from a control room. Three sintering machines handle the fines. Many other features.

1-52. Some Geology and Mineralogy of the Indin Lake Area, N. W. T. E. O. Lilge. *Western Miner*, v. 20, April 1947, p. 52-59.

Some data from ore-dressing investigations involving flotation and cyanidation of gold ore from the above area.

For additional annotations indexed in other sections, see:
2-54-75; 26-63.

2 SMELTING AND REFINING

2-50. Slagging Gas Producer for Melting Foundry Iron. H. LaPlanche. *Metal Progress*, v. 51, March 1947, p. 447-450.

Installation consists of a gas-producer cupola with a capacity of 3 tons per hr. Results demonstrate the utility of the gas-producer cupola in melting iron for hot charges into an open-hearth furnace producing a hot iron of low phosphorus content, which can be rapidly refined, and at the same time making a gas of good calorific value for use either in the openhearth furnace itself or in other necessary heating operations around the steel mill.

2-51. Thermal Requirements for Blast Furnace Operation. Charles E. Agnew. *Steel*, v. 120, March 24, 1947, p. 104, 106-107.

Enrichment of the blast with oxygen as a means of increasing the heat in the hearth and bosh; the wide difference in the weight of raw materials used in the production of a ton of pig iron.

2-52. Observations on Coke Oven and Blast Furnace Practice at the Geneva Plant. C. L. Waggoner. *Blast Furnace and Steel Plant*, v. 35, March 1947, p. 325-328.

Problems involved in using Utah coal generally considered as noncoking, and which varies considerably in quality. Limestone and iron ore available and the practices developed for their satisfactory utilization.

2-53. Blowing Oxygen-Enriched Air Into the Blast Furnace. Kurt Neustaetter. *Blast Furnace and Steel Plant*, v. 35, March 1947, p. 329-332.

Theory; the German experimental runs; the meager and vague information that has come out of Russia. (Paper presented before the Blast Furnace and Coke Association of the Chicago District, Jan. 31, 1947.)

2-54. Some Economics of Blast Furnace Operation. Part II. James Dale. *Blast Furnace and Steel Plant*, v. 35, March 1947, p. 340-343.

Benefits to be obtained from certain crushing, sizing, and ore preparation techniques, with especial reference to a certain British ore. Refers to several papers on the subject.

2-55. Control of Sulphur Content of Sponge Iron Produced in Rotary Kilns. R. C. Buehl, E. P. Shoub and J. P. Riott. *Bureau of Mines Report of Investigations 4057*, March 1947, 102 p.

Results of pilot-plant tests on the reduction of iron ore in a rotary kiln, performed at Johnstown, Pa., and laboratory tests at the Bureau of Mines Central Experiment Station, Pittsburgh, Pa. 32 ref.

2-56. Reduction of Magnesium Chloride by Calcium Carbide. Lloyd R. Michels, Burke Cartwright and S. F. Ravitz. *Bureau of Mines Report of Investigations 4059*, March 1947, 8 p.

A laboratory investigation of the above reaction was made. Results indicate that the reaction is not promising for commercial production.

2-57. Increases Steel Output by Oxygen Impingement Technique. *Steel*, v. 120, March 31, 1947, p. 88.

Increasing temperature of the open-hearth bath by the use of oxygen reduces time of heats from 12 to between 6 and 7 hr. At first oxygen was injected into the bath through a lance thrust into the metal bath to the depth of 6 to 10 in. Now, instead of being blown into the bath, oxygen is impinged on the surface of the bath at high velocity.

2-58. The Manufacture of Oxygen in Large Quantities for Industrial Uses. Martin J. Conway. *Iron and Steel Engineer*, v. 24, March 1947, p. 53-58; discussion, p. 58-60.

The methods used and recent experiments in use of oxygen in open-hearth and blast furnace operations. The economics of these uses.

2-59. Recent Developments in Rare Metals. *Steel*, v. 120, April 7, 1947, p. 93-94, 124, 126, 130, 133.

Advances in technology of thorium, uranium, and zirconium production due to simplification of design and use of high-purity metals in their preparation rather than any changes in basic methods.

2-60. Need Grows for Smelting Fine Iron Ores. *Steel*, v. 120, April 7, 1947, p. 97.

Some of the immediate problems which confront steelmakers, including New York State concentrates, bessemer practice, use of oxygen and high top pressures in blast furnaces, and electric furnace practice.

2-61. Blast Furnace Operation and Materials. *Industrial Heating*, v. 14, March 1947, p. 410, 412, 414.

Factors affecting operating efficiency of blast furnaces, including the physical characteristics of the materials charged. Furnace size and the relationship of furnace auxiliaries to efficiency were included in the discussion, which is limited to soft-ore practice. (Summary of paper by H. W. Johnson read before recent meeting of Pittsburgh Chapter, A.S.M.)

2-62. Recovery of Metals by Electrolysis. W. H. Dennis. *Mine & Quarry Engineering*, v. 13, March 1947, p. 75-82.

The essential features of the recovery of copper, lead, nickel, precious metals, aluminum, magnesium, manganese, zinc, and cadmium, by electrolytic means.

2-63. Acid Electric Steel for Castings. Sam F. Carter and C. K. Donoho. *Electrochemical Society Preprint 91-12*, 1947, 18 p.

Production of steel for castings in the acid-lined electric-arc furnace from the standpoint of the effect of variables in melting practice and final deoxidation on the quality of the steel as revealed by tensile tests. Experimental data treated statistically to reveal effects of several commercial practices; and the theoretical background used to explain the effects noted. A furnace practice to produce high quality steel; effects of final deoxidation methods.

2-64. Application of Slag Control and an Investigation of Basic Openhearth Furnace Slags. T. Fairley. *Journal of the Iron and Steel Institute*, v. 155, Feb. 1947, p. 161-171.

A method of slag control for fixed basic openhearth furnaces which is based on a combination of existing practices, and results of a statistical survey of the chemical compositions of the melting and tapping slags of 250 casts made by its application.

2-65. The Determination of the Equilibrium Constant of the Reaction Between Molten Iron and Hydrogen Sulphide. J. White. *Journal of the Iron and Steel Institute*, v. 155, Feb. 1947, p. 201-212.

Attempts to determine the value of the constant made by use of a high-temperature balance and in a modified apparatus in which four small beads of metals were subjected simultaneously to the action of the gases in a reaction chamber small enough to be contained entirely in the hot zone of the furnace. Apparatus, procedure, and results.

2-66. O Problema do Hidrogenio Na Producao de Aco. (The Problem of Hydrogen in Steel Production.) Luiz Correa da Silva. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 39-62; discussion, p. 62-64.

A critical review of existing theories, including an attempt to reconcile contradictory points of view. 17 ref.

2-67. Eletro-Acos Basicos. (Basic Electric Steels.) Ferruccio Fabriani. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 65-77; discussion, p. 77-78.

Using 250 specimens of S.A.E. 1025 steel, variations in mechanical and chemical properties corresponding to different runs were studied. Production technique emphasizing the differences between laboratory production and production on an industrial scale.

2-68. Generalidades Sobre as Grandes Lingoteiras. (Generalities Concerning Large Ingot Molds.) Mancel A. Moraes. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 185-203; discussion, p. 203-206.

A compilation of data concerning the production of the above. It discusses methods of molding, different compositions used, shapes and dimensions, and chemical properties of the materials used. In the study of defects, the phenomenon of growth was found to occur in iron subject to severe temperature conditions. Silicon was added to counteract acid attack.

2-69. Ingot Mold Usage. (Concluded.) N. H. Bacon. *Iron and Steel*, v. 20, March 1947, p. 89-92.

The value of statistical methods in its study.

2-70. Recent Developments in Steelmaking. J. A. Kilby and W. G. Cameron. *Engineering*, v. 163, March 21, 1947, p. 209.

Blast-refining, electric-furnace, and openhearth processes; the effect of nitrogen, furnace design, materials handling, scrap-pig ratio. (Condensation of paper presented to the Institution of Engineers and Shipbuilders in Scotland, Feb. 4, 1947.)

2-71. Production of Alumina by the Lime-Soda Process. Part III. W. E. Prytherch, M. L. R. Harkness and W. D. Spencer. *Chemical Age*, v. 56, March 22, 1947, p. 339-343.

The literature on the various alkaline, acid, and miscellaneous processes. 25 ref. (To be continued.)

2-72. Basic Electric Steel, Single Slag Process. M. V. Healey and R. W. Thomas. *American Foundryman*, v. 11, April 1947, p. 100-103.

In the comparison of molybdenum alloy sand castings of basic openhearth and basic electric steel, it was noted that the basic openhearth product has certain desirable metallurgical characteristics that are absent in the basic electric product made by the double slag process. Improvement in basic electric steel was accomplished by thorough boiling and elimination of the reducing slag.

2-73. Basic Slags and Dephosphorization. Part II. Frank Norris. *Industrial Heating*, v. 14, April 1947, p. 606, 608.

Molten basic openhearth slags; fixation of phosphorus and reversion; estimation of phosphorus content, rephosphorization of metal during casting.

2-74. Carbothermic Process for Magnesium at Permanente. A. C. Byrns. *Chemical Engineering Progress* (Transactions Section), v. 43, April 1947, p. 172-173.

The process used and the plant of Permanente Metals Corp. described. Essential feature is the reduction of MgO by carbon to give a mixture of Mg vapor and CO.

2-75. Coke and Iron Practice in Utah. C. L. Waggoner. *Steel*, v. 120, April 21, 1947, p. 112-114.

How better quality coke is produced from coal farther away from outcrop. Yield of coke from Utah coals is 67%. Mixing iron ore faces at mine and bedding system at plant serve to maintain spread of magnetite content to about 4%. Blast pressures from 16 to 18 psi. are employed.

For additional annotations indexed in other sections, see:

3-90-107; 10-66; 14-94-98; 15-14; 16-39-40-44-48-54; 19-100; 25-53-54; 26-60; 27-80.

3 PROPERTIES OF METALS AND ALLOYS

3-88. Creep Data for Nonferrous Metals and High Alloy Irons. Kelvin Sproule. *Metal Progress*, v. 51, March 1947, p. 440-B.

Stress-temperature curves prepared from published information are presented for 20 common metals and alloys.

3-89. Predicting Creep Strength of Metals. Kelvin Sproule. *Metal Progress*, v. 51, March 1947, p. 441-442.

Stress vs. temperature, plotted on semilog paper, give nearly straight lines. One known value for copper was used to predict other values by drawing a line roughly parallel to curves for other metals and alloys.

3-90. German Basic Bessemer Steels. *Metal Progress*, v. 51, March 1947, p. 462-463.

Brief account of tests made on H.P.N., "Hamborn, low-phosphorus, low-nitrogen steel", which is similar to the ordinary basic bessemer steel. Impact tests indicated that both rimming openhearth and killed basic bessemer steels had some advantages over rimming H.P.N. Low-temperature tests indicated a slight superiority of killed H.P.N. over basic bessemer killed with 0.44 lb. aluminum per ton in the as-rolled and normalized conditions, but the two steels are practically equivalent if the basic bessemer is killed with 0.66 lb. aluminum per ton. (Abstracted from "Manufacture of H.P.N. Steel in Belgium, Luxembourg and Germany", by T. P. Colclough and J. Simpson. Report No. 345 of the Office of the Publication Board, Department of Commerce.)

3-91. An Economic Approach to Hardenability. Part I. D. I. Brown. *Iron Age*, v. 159, March 27, 1947, p. 42-47.

Graphical data compare various alloy steels and the cost per unit of hardenability obtained from these steels. The correlated data reveal some interesting features which can be useful in the selection of the most economical alloy steel for the purpose intended.

3-92. Hydrogen in Magnesium Alloys. *Metal Industry*, v. 70, March 7, 1947, p. 153.

Investigation shows that hydrogen porosity is only likely to be encountered if there is more hydrogen in the molten metal than can remain in solid solution when solidification occurs.

3-93. The Aging of High-Tensile Structural Steel. A. Fry and L. Kirschfeld. *Welding Journal*, v. 26, March 1947, p. 149s-152s.

Results of an investigation of failures in welded bridges which occurred in Germany and Belgium. It was found that normalizing of ST 44 and ST 52 high-tensile steels did not prevent development of brittleness and plastic deformation on aging. Experiments were also conducted using new specimens of the above steels. Recommends deoxidation of structural steels with aluminum. Yield-point acceptance tests do not give satisfactory assurance of safety. (Abstracted by D. Rosenthal from *VDI Zeitschrift*, v. 87, March 6, 1943, p. 123.)

3-94. Contribution a l'Etude des Fontes Spéciales a Haute Résistance Méchanique. (Contribution to the Study of Special Cast Irons Having High Mechanical Resistance.) Georges Delbart and Rubin Potaszkin. *Fonderie*, no. 12, 1946, p. 444-445; discussion, p. 445.

The mechanical properties of 12 varieties of cast iron prepared in a basic arc furnace, including low-carbon unalloyed, nickel-chromium and nickel-molybdenum cast iron.

3-95. An Economic Approach to Hardenability. Part II. D. I. Brown. *Iron Age*, v. 159, April 3, 1947, p. 53-55, 160.

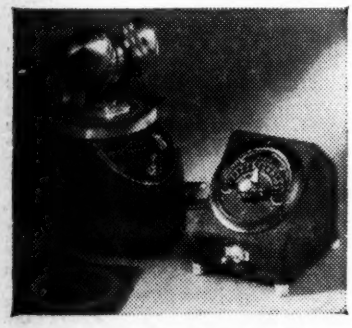
The minimum H-band DI is a reliable, simple index in attacking the problem of using the cheapest alloy which will satisfactorily make the part. Correlations of "cost-per-unit hardenability" data of various H-steels

(Turn to page 16)

Progress in wear testing is reflected in three new accessories designed for use with the Taber abraser, a device made by Taber Instrument Corp. for testing normal abrasive wear of electroplated coatings, organic finishes, anodized films, and other surfaces. One of these, a vacuum pickup unit (R-477) is designed to prevent accumulation of abradings from interfering with the normal wear action of the abrading wheels in the tester.

Its functions are *(a)* to remove the fine powder from certain types of organic coatings that tends to cling to and build up on the face of the instrument's "Calibrase" wheels; and *(b)* to remove abradings that may become embedded in the weave of textile fabrics. This accessory provides controllable suction and has an adjustable nozzle that swivels to the proper position over the specimen in relation to wear-track.

A second accessory is an electrical timing device (R-478) which enables any Taber wear test routine to run any number of cycles up to 1000.



Taper Abraser Equipped With Interval Timer

Third is a duplex refacing stone (R-479) used for resilient-type Calibrase wheels. It replaces the abrasive-coated paper disks formerly employed, and provides improved control and more dependable standardization of wheel surfaces. One side of the stone is a coarse grit for refacing wheels at the start of an abrasion test, and the other has a fine grit used at intervals during the test.

Flaw Detection—Radiography

Most spectacular development in the field of X-ray equipment for radiography is the much-publicized 20-million volt betatron built by Allis-Chalmers Mfg. Co. (R-480). A new production model is now available which is designed for plants rather than laboratories. Only ordinary X-ray technician skill is required to operate it.

The betatron operates from 25 kw. of 180-cycle alternating current at 5000 volts, supplied from a 60-cycle, 440-volt line. In each cycle—180 per sec.—a short burst of electrons is emitted from a vacuum-tube filament; these electrons are spun around and around about 350,000 times, in a doughnut-shaped tube placed within the poles of an electromagnet, acquiring an energy of 20 million electron volts and a velocity almost that of light; an auxiliary turn of the magnet is then energized, allowing these speeding electrons to circle outward and strike a platinum target; this impact generates a cone-shaped beam of X-rays (180 pulses each second) which proceed in a direct line with the electron beam.

The effective target is less than 0.010 in. wide, thus giving nearly a point source and a high order of definition on radiographs; flaws 0.060 in. in size may be detected in 18 in. of steel at any depth.

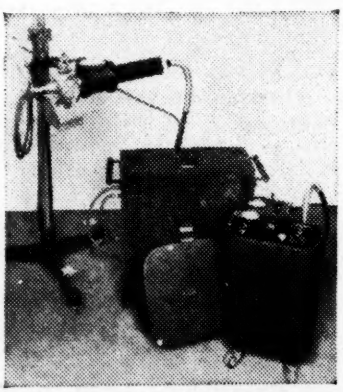
St. John X-Ray Laboratory has a new X-ray back-reflection unit for field inspection (R-481). This equipment is particularly useful for stress analysis, such as in determining residual stresses in welded ship plate, or checking for possible fatigue cracks in bridges and other structures.

The equipment consists of three parts —generator with meters and controls, pump for circulating and cooling water, and the X-ray tube mounted on a flexible stand. The unit is self-rectified, shock-proof, and the tube is ray-proof. The tube in the unit illustrated has a cobalt target for work on steel.

The back-reflection camera is mounted to the tube window. The circular film holder is oscillated during exposure by a small motor also mounted on the tube base. Unique feature of this method is that the X-ray beam falls through the center of the film onto the object, from which it is reflected back to the film where it registers a pattern. This pattern serves to calculate existing stresses. The unit is portable and comparatively simple to use, yet highly accurate.

Eastman Kodak Co. writes that no new products have been brought out during the past year, but calls attention to the 122-page book just issued on "Radiography in Modern Industry" (R-482, $3.00 per copy). This is a dependable text containing the fundamental knowledge necessary for efficient radiographic practice.

North American Phillips is responsible for two new devices—an auxiliary fluoroscope and an X-ray scanner, both for use with the company's Norelco Searchray 150 unit. The fluoroscope (R-483) has a collapsible pipe framework and mounted screen that fits neatly into the specimen compartment of the Searchray. Thus small objects can be examined in a large specimen compartment and distance of specimen from target can be reduced. A safety lead-glass window inserted in the sliding compartment doors permits the operator to observe and position the equipment under study.



X-Ray Back Reflection Unit

The X-ray scanner (R-484) consists of a motor-driven table on which the specimen and film move beneath an adjustable slit through which the X-rays pass. Speed of the table is adjustable between ½ and 1½ in. per min. The scanner overcomes distortion and displacement and precisely records geometric relationship of integrated components. It may also be used to determine unknown thickness of material and to study intergranular structure.

Automatic and economical processing of X-ray film is promised by Pako Corp.'s Model 14 X-ray Filmachine (R-485). Clean, uniform radiographs are delivered at the rate of 120 14x17-in. films per hr. Every film is submerged and agitated in each solution a predetermined interval of time, as the loaded hangers progress automatically through the developing, fixing, washing, wetting and drying stages.

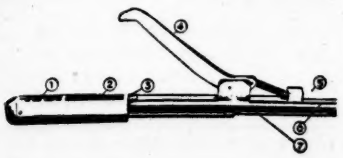
Magnetic Particle Methods

A line of automatic equipment for nondestructive magnaflux testing of parts in production is currently in course of preparation by Magnaflux Corp. First of these is known as the BACS (R-486), a unit for production-line inspection of crankshafts and camshafts. Magnetization may be either circular or longitudinal, and concurrent inspection of two sizes of the shafts is provided for. Shafts are carried on a conveyer through the magnetizing unit to the inspection station. Cranks with serious cracks and forging defects are rejected, while satisfactory shafts pass on to be automatically demagnetized and rinsed. Other units are being made for inspection of connecting rods, steering arms, pistons, turbine blades, magnetic and nonmagnetic castings and other parts.

Magnaflux also has brought out a complete Stresscoat outfit known as Model ST-103 for measuring residual stresses in both static and dynamic installations, either outdoors or indoors (R-487). It includes all necessary equipment for applying the brittle coating, drilling a small hole and applying the red dye etchant. The resulting pattern will be either radial lines surrounding the hole to indicate residual tension or circles indicating residual compression. A ⅛-in. drill is ordinarily used, although drills as small as 1/32 in. can be furnished for very small sections. A tungsten carbide tipped drill is used for very hard materials. The amount of residual stress present

can be judged by the distance the regularly formed lines extend from the hole, thus providing a rough quantitative measurement.

Development of a 100-watt black light one-third the size of a cigarette, for use with a specially developed borescope and Zyglo or Magnaglo fluorescent penetrants, now permits inspection of hitherto inaccessible locations (R-488). This is a joint development of Magnaflux Corp. and Lenox Instrument Co., and was originally designed for inspection of airplane propellers. The head of the black light borescope, shown in the sketch, includes



Head of the Black Light Borescope

white lights (1) to aid visual checking of location and appearance of the defects; filter and lens over black light (2); viewing prism (3); focus guide and control (4 and 5); ½-in. diameter optical tube (6); and tube for carrying the wiring and cooling gas for the lamp (7).

In magnetic particle testing of large castings and forgings it sometimes happens that the magnetic field is not strong enough to bring out the particle pattern, or that identical flaws appear to be of different sizes because of variations in the magnetic field. A new magnetic-field gage introduced by General Electric (R-489) is therefore very useful in assuring a field that is sufficiently strong to bring out the particle pattern; by giving a direct indication of field strength, it permits standardized testing at fixed intensities.

The instrument consists of a gage head permanently attached to a field strength indicating unit. The head contains small coils wound around a U-shaped laminated metal core mounted in a plastic handle. Pole shoes are attached to the ends of the core, and these make contact with the piece being tested. Direct or alternating current is then applied to the part. The current is increased or decreased until the magnetic-field gage indicates the desired field units for the particular test. The magnetic particles are then applied in the specified way.

Supersonics

Sonic methods of flaw detection are exemplified by two well-known instruments—the Brush Hypersonic analyzer and the Sperry supersonic Reflectoscope. Neither can be classed as a new development during the past 12 months, but their commercial applications to production-line inspection are still recent and rapidly increasing.

An industrial model of the Reflectoscope (known as Type B to distinguish it from the laboratory model, Type A) was announced quite recently by Sperry Products Corp. (R-490). This instrument utilizes reflected waves to detect deep-seated laminations and small cracks. Vibration frequency is determined by a crystal and, in the industrial model, heads fitted with crystals of various frequencies can be interchanged. Curved crystals may be substituted for standard flat ones for mass inspection of cylindrical parts. Furthermore, one crystal can be employed as transmitter and a separate crystal as pick-up. Accuracy of linear measurements is approximately 1/16 in.; using a 0.25-sq.in. crystal, lateral location of a small flaw can be determined to within approximately ⅛ in.

The Brush Hypersonic analyzer (R-491) detects flaws by transmission of waves rather than by reflection. It is particularly suited to inspection of rolled sheet, tubing, and of bonded materials to locate minute separations. Flaws 0.001 in. thick can be detected.

An "ultrasonic" tester built on the same principles as the Brush instrument was recently announced by General Electric Co. (R-492). It is said

The Jarrell-Ash Projection Comparator Microphotometer

to be applicable to production testing of metal castings, large forgings or finish-machined parts. The tester is portable and provides a direct reading. It consists of a complete wide-band ultrasonic transmitting-receiving system having a high-frequency generator, a crystal transducer for producing ultrasonic vibrations, a satisfactory medium such as water to transmit these vibrations, a second crystal transducer to convert the received mechanical energy into electrical signals, and an indicator.

To examine regularly shaped specimens, the two transducers are immersed in a tank containing water, and the specimen is inserted between them. Ultrasonic waves are then sent through the specimen, and the resulting reading on the indicating instrument is compared with that for a specimen shown to be sound by X-ray, mechanical breakage, or sectioning methods. Internal flaws will produce measurable decreases in total transmission of waves through the specimen, and a consequent drop in the instrument reading.

Spectrographic Analysis

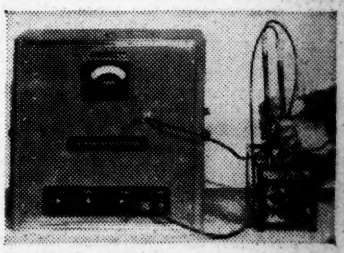
Big news last year in the field of rapid, automatic analysis of metallic alloys was the development by Dow Chemical Co. of a direct-reading spectrometer. This instrument is now being manufactured, under license from Dow Chemical Co., by Baird Associates; bulletins are available carrying detailed description of the apparatus (R-493).

Another new type of direct-reading spectrometer is a product of W. M. Welch Mfg. Co. (R-494). A pair of wave-length scales, for use with a grating and a prism, respectively, eliminates calculations. A circular scale and vernier scale are included for student use in measuring angle of prism and minimum deviation. Achromatic lenses, tangent screw adjustment for telescope, adjustable slit, illuminated cross hairs and other standard precision features are included.

A new projection comparator microphotometer (R-495) is made by Jarrell-Ash Co. and distributed by National Spectrographic Laboratories, Inc. In qualitative analysis it projects a sample spectrum against a reference spectrum, and in quantitative analysis measures the line blackness accurately and rapidly.

The instrument has been designed not only for work with fixed-position spectrographs but also for spectrographs with an adjustable wave-length range. The stages for the reference spectra, as well as for the sample, will accommodate 4-in. plates, or film, so that several reference spectra on a single plate or film may be used. The field of 10x20 mm. covered by the reference beam is sufficiently large so that plates marked in ink can be used as reference spectra. The plates are uncovered during projection and so are accessible for working in ink while they are actually being observed.

The sample spectrum is illuminated by a brilliant line image, 0.1 mm. wide, surrounded by a less intense field 8x8 mm. The line image is projected on the photocell slit. This arrangement



General Electric Ultrasonic Tester

reduces scattered light to a minimum, resulting in higher microphotometer resolutions and a straight-line characteristic curve up to densities of 2.5 and over. The sensitivity is adequate to give full-scale deflections for a clear plate with a photocell slit equivalent at the plate to 10 microns by 1 mm.

(Turn to page 17)

indicate some interesting economic concepts surrounding the use of alloys which are based primarily on hardenability.

3-96. Hardness of Magnesium Alloys. *Materials & Methods*, v. 25, March 1947, p. 121.

Studies made in Great Britain upon a number of the magnesium alloys indicate that hardness of the metal in the as-cast condition, after solution treatment, and in the fully heat treated state is related to the aluminum content. Formulas constructed were based upon empirical data so that hardness of a given alloy may be predicted within limits of the range of compositions studied.

3-97. Thermal Properties of Materials. *Materials & Methods*, v. 25, March 1947, p. 123.

Specific heat (solid and liquid), melting point, latent heat of fusion, boiling point, latent heat of vaporization of various metals, bakelite, resins and rubber.

3-98. The Effect of Changes of Condition of Carbides on Some Properties of Steel. J. B. Austin. *Industrial Heating*, v. 14, March 1947, p. 398-400, 402, 404, 406, 408.

Possible variations in the composition of cementite by variation in the ratio of the number of metal atoms to the number of carbon atoms, or through replacement of iron or carbon by another element. The effect of such variations on some of the properties of steel. (Condensation of the Campbell Memorial Lecture presented before the American Society for Metals.)

3-99. The Properties of Magnetic Metals and Powdered Iron Cores at High Frequencies. D. Moehring. *Headquarters Air Materiel Command Translation F-TS-1047-RE*, March 1947, 33 p.

Properties of magnetic metals and metallic mixtures when subjected to high-frequency currents.

3-100. Un Duralumin Amélioré. A Maturation Lente pour Rivets. (An Improved Duralumin. Slow Aging for Rivets.) Yves Bresson. *Revue de l'Aluminium*, Dec. 1946, p. 384-390.

A new alloy containing 2% Cu and traces of Si and Mg is proposed for rivets able to withstand cold-riveting. Properties and influence of various alloying elements.

3-101. The Resistance to Cavitation Erosion of Propeller Alloys. R. Beeching. *Transactions of the Institution of Engineers & Shipbuilders in Scotland*, v. 90, Jan. 1947, p. 203-230; discussion, p. 230-245.

An investigation of the effect of composition upon resistance to cavitation erosion for several series of alloys. The composition ranges examined embraced all the more satisfactory types of alloy which have been used for propellers up to the present. Several ways of producing propeller alloys with combinations of mechanical properties superior to manganese bronze or aluminum bronze.

3-102. The Deformation of Tin-Base Bearing Alloys by Heating and Cooling. W. Boas and R. W. K. Honeycombe. *Council for Scientific & Industrial Research, Section of Tribophysics, Melbourne, Australia, Physical Metallurgy Report No. 2*, Jan. 28, 1947, 12 p.

The deformation of some tin-base alloys by cyclic thermal treatment. The results of cyclic thermal treatment of tin-base and lead-base bearings compared. The phenomenon of deformation is shown to be absent in the lead alloys. The significance of the results, as applied to both bearing practice and to metallurgy as a whole.

3-103. Transverse Magnetization in Ferromagnetic Crystals in Relation to Domain Structure. A. von Engel and M. S. Wills. *Proceedings of the Royal Society*, v. 188, Feb. 25, 1947, p. 464-484.

According to existing theory, the transverse component should increase as the field strength diminishes, whereas experimental results show that it becomes zero in very weak fields. To account for this, a simple treatment is developed which covers the whole range of field strength. The directions of magnetization of domains are treated as distributed continuously in angle, rather than restricted to a limited number of particular directions. By assuming that the proportion of the volume of domains magnetized in any direction is larger the lower the energy of magnetization in that direction, reasonable agreement with the experimental results is obtained.

3-104. Reflectivity of Steel. R. Weil. *Nature*, v. 159, March 1, 1947, p. 305.

The reflective properties of two stainless steels at different temperatures and in different portions of the spectrum. The apparatus used and results.

3-105. Cast Iron and Steel. Ernest C. Pigott. *Iron and Steel*, v. 20, March 1947, p. 93-95.

Influence and commercial applications of constituent elements. Chromium in stainless steel and cast iron; cobalt; copper; hydrogen; lead. (To be continued.)

3-106. Room Temperature Tensile Properties of Aluminum Alloy Sheet Following Brief Elevated Temperature Exposure. J. T. Lapsley, A. E. Flanigan, W. F. Harper and J. E. Dorn. *Journal of the Aeronautical Sciences*, v. 14, March 1947, p. 148-154.

Above properties of nine types determined after elevated temperature exposure covering a range of times and temperatures suitable for forming.

3-107. Low-Cost Boron Elevates Steel Properties. *SAE Journal*, v. 55, April 1947, p. 65.

Work conducted for Army Ordnance showed substantially equal effectiveness for each of seven different forms of boron in improving the properties of 0.45% carbon, 1.50% manganese steel. (Summary of report soon to be available from S.A.E.'s special publication department.)

3-108. Selection of Carbon Steels for Metallizing. *Metco News*, v. 3, April 1947, p. 11-12.

The necessity of considering the properties of the deposited metals rather than those of the metals in other forms. Graphs show ultimate strength and ultimate strain vs. carbon content.

3-109. The Flow of Metals at Elevated Temperatures. Part II. J. H. Hollomon and J. D. Lubahn. *General Electric Review*, v. 50, April 1947, p. 44-50.

The general equation relating stress, strain, strain rate, and temperature was applied to cases in which temperature or strain rate is not constant during deformation. Results of experiments on effect of strain rate and temperature histories, and on the relationship between tensile and creep test data. Certain unsolved problems for future research.

3-110. Discussion of Paper on an Investigation of the Effect of Welding on the Transition Temperature of Navy High-Tensile Low-Alloy Steels. G. F. Comstock. *Welding Journal*, v. 26, April 1947, p. 251s-252s.

Results presented in paper by G. G. Luther and others in October 1946 issue are charted in such a way as to indicate the effect of titanium and other alloys on the weldability of Navy high-tensile steel.

3-111. High Chromium-Irons. H. D. Newell. *Metal Progress*, v. 51, April 1947, p. 617-626.

The nonhardenable commercial alloys containing from 12% to 24% chromium; physical and mechanical properties; structural features; embrittlement; applications.

3-112. Evaluating High Heat Properties of Steels. Herbert Dobkin. *Steel*, v. 120, April 21, 1947, p. 86-87, 120, 122, 124.

The significance and methods of measuring elevated-temperature properties of various steels; the types of materials generally used in high-temperature applications.

3-113. "Hot Hard" High Speed Steel. H. G. Johnstin. *Steel*, v. 120, April 21, 1947, p. 98, 100.

Requisite wear and heat resistance imperative for successful cutting of materials of higher hardness at elevated temperatures developed in service.

3-114. On Wear Resistance of Gray Irons. *Nickel Cast Iron News*, v. 18, Second Quarter 1947, p. 4-5.

The wear resistance of various types, and classification of the gray irons into eight structural and alloy types in order of their wear resistance. Micrographs.

For additional annotations indexed in other sections, see:
2-67; 4-46-47; 9-48; 12-60; 22-160-167-172-205-219-223; 23-93; 27-87.

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4 STRUCTURE — Metallography & Constitution

4-36. A Velocity-Modified Temperature for the Plastic Flow of Metals. C. Zener and J. H. Hollomon. *Journal of Applied Mechanics*, v. 14, March 1947, p. A-70-A-71.

Discussion of paper by C. W. MacGregor and J. C. Fisher, published in March 1946 issue, and author's reply. Questions the equation used to relate stress, strain, strain rate, and temperature.

4-37. Fractographic Structures in Zinc. Carl A. Zapffe. *Metal Progress*, v. 51, March 1947, p. 428-431.

Excellent photographs by George A. Moore of Battelle Memorial Institute show natural cleavage structure at 250 and 500 diameters. The features revealed indicate that zinc fractures similarly to bismuth.

4-38. L'Existence de Phenomènes de Retard Thermique a la Solidification pour l'Aluminium Raffiné a 99.99% et Son Application a la Préparation de Cristaux Uniques. (The Presence in Refined Aluminum (99.99% Pure) of the Phenomenon of Thermal Solidification Delay, and Its Application in the Production of Monocrystals.) Paul Lacombe and Louis Beaujard. *Comptes Rendus*, v. 224, Jan. 13, 1947, p. 116-118.

The phenomenon of supercooling of aluminum and the method of production of aluminum monocrystals based on this phenomenon.

4-39. Further Observation of Graphitization in Aluminum-Killed Carbon-Molybdenum Steel Steam Piping. R. W. Emerson and Matthew Morrow. *Welding Journal*, v. 26, March 1947, p. 139s-149s.

Results of a macroscopic and microscopic examination of several joint failures from the Springdale Power Station, in which a graphitization condition different from anything previously encountered was found. The segregation had occurred along slip planes where local yielding or plastic

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Davis Instrument Mfg. Co. has a new device to facilitate reading spectrophotometric curves (R-496). In this apparatus the curve, wave-length scale and reflectance scale are juxtaposed for reading. Means for magnifying the curve and related scales, setting the wave length accurately, and progressing quickly from point to point along the curve are provided.

Harry W. Dietert Co.'s Dunn Lowry drum calculator (R-497) accelerates spectrographic analysis by calculating the composition with a series of working scales similar to the ordinary slide rule. The calculator consists of a board for plotting the curves, and a large rotary drum which carries the analytical scales. Relative intensity is measured by a movable horizontal logarithmic scale at the bottom.

Sorting Equipment

Three new comparator-type instruments for sorting of metallic materials are on the market, one of which was offered by Magnetic Analysis Corp. last month (R-498). This magnetic comparator, Model 4-47 for ferrous materials, consists of a combination indicator and control unit and a set of two coils with inside diameters ranging from ½ to 6 in. It uses a meter as an indicator to show differences in *(a)* chemical composition and variation in heats; *(b)* in heat treatment, hardness and structure; *(c)* in size and shape; *(d)* in mechanical processing; and *(e)* in internal strain and stress. Speed of inspection varies greatly with size and shape of parts, but will range from 300 to 1500 units per hr. It can be operated by an unskilled worker and requires no preliminary preparation of material or parts.

Another magnetic comparator for ferrous materials is a new Ferrograph (R-499), made by Allen B. Du Mont Laboratories, originators several years ago of the Cyclograph. Principle of the new Ferrograph is harmonic analysis of induced voltage in the secondary of a transformer with the test sample as a core. Differentiation of materials is indicated by amplitudes and phase angles of fundamental and third harmonic components.

A new Type B Metalsorter is a smaller, portable model of the original Type AX brought out 18 months ago by Control Equipment Co. (R-500). It weighs only 40 lb., and requires no special electrical power supply. The Metalsorter employs the tribo-electric effect. A metallic specimen of known character is rubbed against the surface of an unknown. If a chemical or metallurgical dissimilarity of the two pieces exists, a minute electrical current is generated and is registered by an indicator on a calibrated scale. When there is no dissimilarity, no electrical current is indicated.

The control unit of the Metalsorter contains a thyratron-operated timing circuit, an electronic bias supply and a measuring circuit. A reciprocating tool is connected to the control unit by means of a multiple conductor cable and plug. The tool is provided with a specimen-holding chuck and a flexible lead for connection to the metal to be tested.

Surface Analysis

A new Model BL-103 of Brush Development Co.'s surface analyzer (R-501) uses a fine diamond point to check surface finishes from less than 1 to 5000 micro-inches. An instantaneous chart record on the magnetic direct-inking oscillograph provides an accurate "peak and valley" profile of the surface finish. Warmup time is 2 min.

The surface analyzer consists of a pickup arm, drive head, amplifier, magnetic direct-inking oscillograph, surface plate, carrying cases, glass calibration standard, two V-blocks and necessary chart paper and ink. Accessory equipment includes the RMS meter which provides a constant visual check of root mean square surface roughness where peak and valley profiles are not needed. Accessory pickups for hard-to-get-at surfaces such as flanks, threads, tool edges and wire surfaces, walls of bores and rough finishes, are available.

DoAll Electronic Segregator

For taking micro-inch surface roughness measurements in deep bores, such as hydraulic cylinders, camshafts and tubing, Physicists Research Co. has developed a new tracer (R-502) to be used with its Profilometer. This tracer, known as Type LA, will measure to any desired depth in holes as small as ¾ in. i.d. The diamond tracing point is self-adjusting to the work surface. The tracer is mechanically operated by means of a Mototrace and Linkarm. By using Linkarms of the proper length for each application, measurements can be taken with the one tracer at various depths to 36 in. or greater.

Physicists Research Co. also has a Profilometer reading recorder (R-503) to provide a written record of the surface roughness measurement. The recorder provides a continuous chart record in micro-inches and attaches at the meter jack on the Profilometer.

A replica surface analyzer operated by a photo-electric cell has recently been devised at the Bureau of Standards (R-504). A restricted beam of light is passed through an oscillating plastic replica of the surface, thence through a suitably restricting diaphragm onto a photo-electric cell. Minute variations in the number and nature of the proturberances and [illegible] on the replica film cause corresponding variations in the intensity and angle of refraction of the light transmitted by the replica. A correspondingly varying current is generated in the photo-electric cell. Meter readings are translated into roughness evaluations by calibrating against surfaces of known roughness as determined by microscopic means. Use of the plastic replica eliminates the danger of scoring the surface of soft alloys by a diamond tracer or stylus.

A plastic replica is also utilized in a comparator-type unit—the new Model D-30 Faxfilm dual projection unit (R-505). A quick comparison of a production finish with a standard finish is made in a microprojector. Images appear side by side at 30 magnifications on a screen at the base of the instrument. Curved and conical shapes and inside or outside diameters, as well as flat surfaces, may be examined.

Size Inspection—Gages

Space limitations permit only brief mention of a few of the many automatic devices for checking sizes and tolerances on materials and parts in process. Low-cost, 100% automatic inspection of small parts is provided by the DoAll Selector (R-506). The Model DS-20 is an electronic segregator for sorting into three classifications—oversize, acceptable, and undersize. The Selector is accurate to 0.000010 in. and will sort with tolerances from ±0.0001 to ±0.0005 in. at speeds up to 12,000 parts per hr.

Sheffield Corp. has announced four new inspection devices since the first of the year. An automatic hopper-fed roll selector (R-507) for 100% inspection of small precision parts such as roller bearings, dowel pins, and chain links gages them to a tolerance of 0.005 in. and segregates them into four classifications as to oversize and undersize on both diameter and length. (See illustration on page 19.)

A new Sheffield horizontal external comparator for rectangular, threaded or cylindrical parts, tapered or straight (R-508), has a wide range of adjustability up to 3½ in. in height and 10½ in. in length. It can be set up to read to millionths of an inch, and may have either standard or micrometer tailstock; changeover is simple and rapid.

Another automatic segregating instrument is specially designed for inspection of compression and oil piston rings at the rate of 2400 per hr. (R-509). It checks thickness to a tolerance limit of 0.0005 in. and gap width to a tolerance of 0.007 or 0.010 in.

The fourth new Sheffield installation is the Airlectric Multichek for automotive pistons (R-510) which provides eight automatic classifications. Rate of inspection and selection is between 500 and 700 pistons per hr., depending on the operator, who merely loads and unloads the parts.

A new comparator gage made by

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Theories to explain the results observed, and also to explain isothermal graphitization. 22 ref.

4-40. Atomic Radii and Interatomic Distances in Metals. Linus Pauling. *Journal of the American Chemical Society*, v. 69, March 1947, p. 542-553.

An equation was developed to express change in metallic radius of an atom with change in bond number or coordination number. This equation was applied to empirical inter-atomic-distance data for the elementary metals to obtain a nearly complete set of single-bond radii. Comparison of these radii with normal covalent radii, tetrahedral radii, and octahedral radii indicates that interatomic forces in metals are mainly due to covalent bonds resonating among available interatomic positions. It was found that chromium, manganese, and tin atoms exist in metals in two forms. Use of the radii is illustrated by discussion of cementite and AuSn.

4-41—Internal Oxidation. F. N. Rhines. *Corrosion and Material Protection*, v. 4, March-April 1947, p. 15-20.

Present status of the knowledge of internal oxidation (subscale formation). The rate of advance of the front of oxidation is controlled cooperatively by the diffusion rates of oxygen and the reacting element. Attempts to show a hardening effect by precipitated oxides, analogous to the age-hardening effect, have been fruitless. Precipitated oxides appear to influence the modes of recrystallization and grain growth.

4-42. The Effect of Temperature on the Intensity of X-Ray Reflection. E. A. Owen and R. W. Williams. *Proceedings of the Royal Society*, v. 188, Feb. 25, 1947, p. 509-521.

Effect of temperature on intensity of X-ray reflection by gold, copper, and aluminum studied by making microphotometric measurements on lines in X-ray structure spectra obtained with powder specimens in Debye-Scherrer camera. A special method was used to make cylindrical powder specimens, 0.8 mm. in diameter, which held together without adhesive and were free from a core of foreign material.

4-43. The Anisotropy of Thermal Expansion as a Cause of Deformation in Metals and Alloys. W. Boas and R. W. K. Honeycombe. *Proceedings of the Royal Society*, v. 188, Feb. 25, 1947, p. 427-439.

Plastic deformation produced by repeated heating and cooling of certain noncubic metals in the range from −190 to 250° C. The extent of the deformation which results from the anisotropy of thermal expansion of individual crystals becomes greater as the temperature range is increased. In order to investigate the interaction between the crystals of the two phases of a duplex alloy during cyclic thermal treatment, experiments were conducted with a series of tin-rich tin-antimony alloys. It was found that deformation in the boundary region between crystals of the two phases was considerably smaller than that in the crystal boundary region of the anisotropic matrix. Similar results were obtained with tin-base bearing alloys. 19 ref.

4-44. The Microstructure of Commercial Acid Resisting Silicon-Iron Alloys. J. E. Hurst and R. V. Riley. *Journal of the Iron and Steel Institute*, v. 155, Feb. 1947, p. 172-178.

Influence on the microstructure of variations in silicon content, of additions of certain alloying elements, and of adventitious impurities.

4-45. Diffusion in Solid Metals. *Metal Industry*, v. 70, March 21, 1947, p. 192-193.

Practical aspects; experimental methods; movements of interface.

4-46. The Silicon Carbide Addition in Gray Iron Automotive Castings. E. A. Peterson. *Metal Progress*, v. 51, April 1947, p. 587-592.

A method of inoculation that obtains, in practice, those effects considered essential to the production of automotive castings possessing a very dense grain structure together with a high degree of machinability. Comparison drawn between typical cylinder iron and a similar one treated with silicon carbide. Microstructure has been correlated with properties and performance, which involve machinability, pressure tightness and grain structure.

4-47. Slow Changes in Hardened Steel. Victor Kappel. *Metal Progress*, v. 51, April 1947, p. 611-612.

Structural failures, which were the cause of 12% of airplane accidents in 1945, are believed to be the result of sluggish transformation of structural metal, especially when not completely quenched; austenite transforming to troostite and a structure resembling martensite at low temperatures often encountered in planes. Opinion is backed up by experience in investigating the failure of aircraft parts.

For additional annotations indexed in other sections, see:
7-105; 27-69-73-75.

5 POWDER METALLURGY

5-22. Preparation of Iron Powder Compacts and Powders for Microscopic Examination. H. M. Jamison and E. S. Byron. *Metal Progress*, v. 51, March 1947, p. 437-440.

Precautions which must be taken in the preparation of samples. Procedure described.

5-23. Powder Metallurgy; Influence of Some Processing Variables on the Properties of Sintered Bronze. H. L. Wain. *Australian Council for Aeronautics, Melbourne, Australia, Report ACA-25*, June 1946, 20 p.

Study of compacting pressure and temperature, and time of heat treatment. Mechanism of alloying between copper and tin particles to form alpha bronze during heat treatment of copper-tin-graphite compacts. Time of heat treatment in excess of 30 min. was found to be of less importance than compacting pressure and heat treatment temperature.

5-24. Powdered Metals and the Engineer. H. W. Greenwood. *Transactions of the Institution of Engineers & Shipbuilders in Scotland*, v. 90, Dec. 1946, p. 101-115; discussion, p. 115-125.

Powder metallurgy processes, products, and applications.

5-25. Principles of the "RZ" Process of Iron Powder Production. Scholz. *Powder Metallurgy Bulletin*, v. 2, March 1947, p. 30-34.

German process which has been developed on a laboratory scale. A special low-silicon iron containing 4% carbon is atomized by compressed air at 2460° F. The atomized product, consisting of hollow spheres or spherical fragments of iron covered with an oxide layer, is annealed at 1650° F., to convert it into a readily compactible powder. (Translated from PB 17380, Office of Publication Board, Department of Commerce, Washington, D. C.)

For additional annotations indexed in other sections, see:
20-166; 23-101; 24-96.

SWEDISH IRON POWDERS
Laboratory and Consulting Service
Ekstrand & Tholand, Inc.
441 Lexington Avenue New York 17, N. Y.

6 CORROSION

6-55. Corrosion Protection Lengthens Life of Aluminum Transportation Units. J. F. Mason. *Aluminum and Magnesium*, v. 3, Feb. 1947, p. 14-15, 17, 21.

Precautions to be observed in selecting materials, and design of units. Various protective measures.

6-56. Remedies Studied for Freakish Corrosion Occurring in Some Condensate Fields. D. P. Thornton, Jr. *Petroleum Processing*, v. 2, April 1947, p. 273, 275, 276, 279.

Three years' study of the cause of the spotty attacks of corrosion experienced in gas-condensate fields indicates that lower fatty acids found in well fluids in minute concentrations are principal promoting agents. Various types of chemical inhibitors are being tried with varying degrees of relief. Plastics or other forms of coating are also being investigated.

6-57. The Corrosion of Metals; An Economic Problem Ready for Science. Parts I and II. Hugh J. McDonald. *Illinois Tech Engineer*, v. 12, Dec. 1946, p. 8-11, 29-30, 32, 34, 36; March 1947, p. 13-17, 56, 58.

In Part I, the fundamental principles of corrosion are reviewed, including the various causes of corrosion —those inherent in the nature of the metal and its immediate environment, and external factors. In Part II, the controlling factors in corrosion and its prevention are discussed in more detail. These include: polarization and overvoltage, anodic and cathodic control, use of inhibitors, surface-conversion coatings, corrosion inhibiting paints, and stress-corrosion cracking and fatigue. Finally, a few useful home and shop corrosion prevention "recipes" are given, and the need for further research is emphasized.

6-58. The Corrosion of Water Heaters. Part I. Experiments With Instantaneous Water Heaters. N. Booth, P. C. Davidge, G. H. Fuidge, and B. Pleasance. *Gas Research Board (London), Communication GRB27*, 28 p.

Two standard models of instantaneous sink water heaters were subjected to investigation in an accelerated life test. In both cases heater and fins were constructed of "tinned" copper. At the end of each series of 1200 heating operations, the corrosion deposit was removed from the heater for weighing and analysis. The main factor investigated was the sulphur content of the gas. Minimum corrosion was found to occur when using a gas containing approximately 3 grains per 100 cu.ft.

6-59. Wet and Dry Chlorine Vs. Materials of Chemical Plant Construction. (Concluded.) *Chemical Engineering*, v. 54, March 1947, p. 213-214, 216, 218, 220.

Short articles on Durimet and Chlorimet; nickel and nickel alloys; and chemical stoneware.

6-60. Summary of Research on Drill Stem Performance. Thomas J. Young. *Drilling Contractor*, v. 3, Feb. 15, 1947, p. 47-49.

From five reports of Battelle Memorial Institute to the Assoc. of Oilwell Drilling Contractors.

6-61. Corrosion Control. Claudius Nielsen. *Organic Finishing*, v. 8, March 1947, p. 19-29.

Different processes metal is subjected to in surface conditioning for fabrication or for the final finish. Evaluates each in relation to corrosion control.

6-62. The Effect of Small Lead and Silver Additions on the Corrosion Resistance of Castings of Magnesium and

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Sheffield Roll Selector

Metron Instrument Co. (R-511) is of the electromagnetic type but does not use vacuum tubes. Each gage has four ranges of magnification, making it suitable for a wide range of applications from checking gage blocks to production inspection of machined parts.

In an electronic comparator gage made by Foote, Pierson Co., Inc. (R-512) a standard-size piece is used to balance an indicating meter to center. After the desired limits of deviation are set up, movement of the gage point in production inspection varies the inductive relationship between two coils to light lamps indicating either standard size or oversize and undersize.

Several new and redesigned pieces of shop equipment have been announced by George Scherr Co., Inc. These include the Gaertner toolmakers' microscope (R-513), which gives a magnified projection of small part profiles with direct measurement in two dimensions plus angular measurements by optical protractor. The Scherr Comparitol (R-514) consists of a base with steel table adjustable in height, a steel ball feeler point, and a measuring head that indicates oversize and undersize in ten-thousandths of an inch. The Wilder micro projector (R-515) measures or compares objects by means of a magnified shadow image of the contour. A recent accessory to this instrument is a surface illuminator which supplements the contour shadow with an image of the surface produced on the screen by reflected light.

A resonance-type thickness gage is designated by its producer, Branson Instruments, Inc., as Model FMSS-4 Audigage (R-516). It is a battery-operated instrument designed to measure thickness from one side only. The Audigage applies a vibrating crystal to a wall surface, causing it to resonate mechanically at a frequency directly proportional to the velocity of sound in the material and inversely proportional to the wall thickness. General Electric also has a thickness gage for measuring iron or steel pipes from the outside (R-517).

A dial indicator gage for holes as small as 0.122 in. i.d. is made by Federal Products Corp. (R-518). Internal defects such as taper, out-of-round and bellmouth are recorded on the dial. A set of 12 interchangeable plugs is included with the instrument.

W. C. Dillon & Co., Inc., has just put the finishing touches on a new remote-indicating mechanical pressure gage (R-519). This instrument will indicate mechanical pressure in vises, chucks, and presses, or will show tension in moving filaments and rods, and is designed for inaccessible jobs where an ordinary gage cannot be seen.

The transmitter motor is mounted to a standard Dillon pressure gage. When load is applied, its electrical field is unbalanced. This electrical excitation is transmitted by cable to the repeater station where the field of the receiving motor is correspondingly unbalanced. Thus, whatever the transmitter motor deflects, the repeater instantly duplicates up to distances of 300 ft.

Addresses of Manufacturers

Allis-Chalmers Mfg. Co. (R-480)
Milwaukee 1, Wis.

Aluminum Research Institute (R-456)
111 W. Washington St.
Chicago 2, Ill.

Ames Precision Machine Works, B. C. (R-462)
Waltham 54, Mass.

Baird Associates (R-493)
University Rd.
Cambridge 38, Mass.

Baldwin Locomotive Works (R-460, 469, 470, 471)
Philadelphia 42, Pa.

Barnes Corp., John S. (R-459)
301 S. Water St.
Rockford, Ill.

Branson Instruments, Inc. (R-516)
Joe's Hill Road
Danbury, Conn.

Brush Development Co. (R-491, 501)
3405 Perkins Ave.
Cleveland, Ohio

Buehler, Adolph I. (R-458)
228 N. LaSalle St.
Chicago 1, Ill.

Control Equipment Co. (R-500)
547 Brushton Ave.
Pittsburgh 21, Pa.

Davis Instrument Mfg. Co. (R-496)
Baltimore, Md.

Dietert Co., Harry W. (R-497)
9330 Roselawn Ave.
Detroit 4, Mich.

Dillon & Co., Inc., W. C. (R-453, 519)
5410 W. Harrison St.
Chicago 44, Ill.

DoAll Co. (R-506)
254 N. Laurel Ave.
Des Plaines, Ill.

Du Mont Laboratories, Allen B. (R-499)
2 Main Ave.
Passaic, N. J.

Eastman Kodak Co. (R-482)
Rochester 4, N. Y.

Faxfilm Co. (R-505)
Room 540—1220 W. Sixth St.
Cleveland 13, Ohio

Federal Products Corp. (R-518)
1144 Eddy St.
Providence, R. I.

Ferner Co., R. Y. (R-457, 466)
131 State St.
Boston, Mass.

Foote, Pierson Co., Inc. (R-512)
Newark, N. J.

Gaertner Scientific Corp. (R-473, 474, 475)
1201 Wrightwood Ave.
Chicago 14, Ill.

General Electric (R-461, 468, 489, 492, 517)
Special Products Division
Schenectady, N. Y.

Magnaflux Corp. (R-486, 488)
5900 Northwest Highway
Chicago 31, Ill.

Magnaflux Corp. (R-487)
25 W. 43rd St.
New York 18, N. Y.

Magnetic Analysis Corp. (R-498)
42-44 12th St.
Long Island City, N. Y.

Metron Instrument Co. (R-511)
436 Lincoln St.
Denver 9, Colo.

National Bureau of Standards (R-504)
Washington 25, D. C.

National Spectrographic Laboratories Inc. (R-495)
6300 Euclid Ave.
Cleveland 3, Ohio

North American Philips Co. (R-483, 484)
100 E. 42nd St.
New York 17, N. Y.

Olsen Testing Machine Co., Tinius (R-450, 451, 452)
500 N. 12th St.
Philadelphia 23, Pa.

Pako Corp. (R-485)
1010 Lyndale Ave., North,
Minneapolis 11, Minn.

Physicists Research Co. (R-502, 503)
321 S. Main St.
Ann Arbor, Mich.

St. John X-Ray Laboratory (R-481)
Califon, N. J.

Scherr Co., Inc., George (R-513, 514, 515)
200 Lafayette St.
New York 12, N. Y.

Sheffield Corp. (R-507, 508, 509, 510)
Box 893
Dayton 1, Ohio

Sperry Products Corp. (R-490)
16th & Willow St.
Hoboken, N. J.

Steel City Testing Laboratory (R-454, 455, 463)
8843 Livernois Ave.
Detroit 4, Mich.

Sylvania Electric Products, Inc. (R-476)
Bayside, N. Y.

Taber Instrument Corp. (R-477, 478, 479)
111 Goundry St.
North Tonawanda, N. Y.

United States Steel Corp. (R-465)
208 S. La Salle St.
Chicago 90, Ill.

Webster, R. A. (R-467)
422 Twentieth St.
Santa Monica, Calif.

Welch Mfg. Co., W. M. (R-494)
1515 Sedgwick St.
Chicago 10, Ill.

Westinghouse Research Labs. (R-472)
East Pittsburgh, Pa.

Wilson Mechanical Instrument Co. (R-464)
230 Park Ave.
New York 17, N. Y.

Certain of Its Alloys at Elevated Temperature and High Humidity. R. R. Rogers and W. Dingley. *Electrochemical Society Preprint 91-13*, 1947, 9 p.

Corrosion resistances of commercially pure magnesium, and the AZ80x, AZ63x, and M1 magnesium alloys, with and without small silver, lead, or silver-lead additions, in air at 204° F. and high relative humidity It was found that the average corrosion rate of these materials may be considerably decreased by the addition of 1% silver. Other additions studied also produce a considerable decrease. These additions do not increase the specific gravity of the metals to a great extent.

6-63. Some Experiments on Corrosion of Steel by Boiling Water. A. J. Gould and U. R. Evans. *Journal of the Iron and Steel Institute*, v. 155, Feb. 1947, p. 195-200.

Behavior of steel in boiling water is determined largely by the position of the formation of solid corrosion products. Under anaerobic conditions, steel reacts at first with water, eliminating hydrogen, but a film is formed over the surface so that the attack over long periods is very slight. In presence of oxygen the conversion of ferrous hydroxide to magnetite, or rust, appears to take place to some extent at a distance from the metal, so that the film is discontinuous and serious corrosion occurs. Salts tend to increase and sodium hydroxide to diminish the attack under aerobic conditions. Copper deposited on part of the steel increases the intensity of attack in short experiments but not in long ones.

6-64. External Deposits on Boiler Heating Surfaces. *Combustion*, v. 18, March 1947, p. 26-28.

A digest of a report issued by the British Boiler Availability Committee covering an investigation of the form and composition of deposits in a large number of boilers examined. The mechanism of deposit formation and the behavior of sulphates, bisulphates, phosphates and chlorides, particularly chemical changes taking place in the vapor phase.

6-65. Internal Corrosion of Furnace Tubes of High-Pressure Boilers. Richard C. Corey. *Combustion*, v. 18, March 1947, p. 39-42.

Experiences with internal tube corrosion at Springdale and Firestone, which were reviewed in the December 1946 issue.

6-66. Use of Corrosion Inhibitors in Products Pipelines—A Survey of Practices. Ivy M. Parker. *Corrosion*, v. 3, April 1947, p. 157-168.

Survey of practice in 20 companies operating products pipelines. 11 ref.

6-67. Cathodic Protection Rectifiers. W. L. Roush and E. I. Wood. *Corrosion*, v. 3, April 1947, p. 169-172.

Wind chargers and engine generator sets and air and fan-cooled rectifiers.

6-68. The Role of Algae in Corrosion. Henry C. Myers. *Journal of the American Water Works Association*, v. 39, April 1947, p. 322-324.

Describes corrosion due to algae which occurred in open steel tanks belonging to the California Water & Telephone Co., in Southern California. The theory of this type of corrosion and attempts to control it. Covering the tanks to cut out the sunlight proved to be the least expensive and most effective control method.

6-69. Corrosion Causes Most Cylinder Wear. *SAE Journal*, v. 55, April 1947, p. 62.

Test setup and conclusions. (Digest of "Minute Amounts of Cylinder Wear Are Measured with a Microscope", by Clarence S. Bruce and Jesse T. Duck.)

6-70. Protecting Pipe in Open Systems. M. D. Appleman. *American Gas Association Monthly*, v. 29, April 1947, p. 194-196.

How anaerobic corrosion may be eliminated through the application of basic principles familiar to soil bacteriologists, soil chemists, and soil physicists; promising directions for future research. 25 ref.

6-71. Magnesium Anodes Protect Cable Sheath. R. L. Featherly. *Electric Light and Power*, v. 25, April 1947, p. 78-82.

A comprehensive analysis of the cable corrosion problem, together with a detailed report of results obtained on several installations of magnesium anodes for cable protection.

6-72. Insulation of Dissimilar Faying Metal Surfaces. B. W. Floresch. *Western Metals*, v. 5, April 1947, p. 22-23.

Tests to determine the optimum organic insulation necessary for protection against galvanic corrosion in various dissimilar-metal contacts. Tests are not correlated with actual service conditions but are designed to show the comparative corrosion resistance of definite dissimilar-metal contacts having various finishing schemes.

6-73. Corrosion. Mars G. Fontana. *Industrial and Engineering Chemistry*, v. 39, April 1947, p. 81A-82A.

Corrosion is classified into eight different forms based on appearance of the corroded metal. A few types are illustrated.

6-74. Glossary of Corrosion Terms. *Chemical Industries*, v. 60, April 1947, p. 618-620.

Glossary prepared for inclusion in the forthcoming Corrosion Handbook, sponsored by the Electrochemical Society and to be published by John Wiley & Sons.

For additional annotations indexed in other sections, see:
3-101; 8-44-50; 11-38; 24-111.

7 CLEANING & FINISHING

7-104. Proper Surface Preparations Assure Durable Finishes. R. E. Gwyther. *Product Engineering*, v. 18, March 1947, p. 153-155.

Methods of preparing metal surfaces prior to painting. Techniques of coating, rinsing, and cleaning for improved paint adherence and resistance to weathering. Recommended types of chemical solvents for soil and scale removal.

7-105. Sur les Phénomènes d'Adsorption et de Désorption se Produisant a la Surface du Fer Après Décapage a l'Acide ou Electrolytique. (Phenomena of Adsorption and Desorption Taking Place on the Surface of Iron After Acid or Electrolytic Etching.) Paul Bastien, Simon Mischnonsniky, and Chantal de Senneville. *Comptes Rendus*, v. 224, Jan. 13, 1947, p. 126-127.

Pickling of iron, by cathodic means or using an acid bath, causes an increase in the hydrogen content of the metal and the elimination of surface oxides. Such a surface possesses high resistance to the adsorption of air. Investigations were performed to prove this assumption and to establish the relation between the adsorption and desorption of air and hydrogen.

7-106. How to Select Coatings for Aluminum. Ray Swan and N. P. Ruther. *Steel*, v. 120, March 24, 1947, p. 78-79, 97, 100.

Suggestions apply to cast, extruded sheet as well as foil aluminum products.

7-107. The Chemical Surface Treatment of Magnesium Alloy Sheet for Spot Welding. W. F. Hess, T. B. Cameron and D. J. Ashcraft. *Welding Journal*, v. 26, March 1947, p. 170s-190s.

Before spot welding, the protective oil or chrome-pickle coating must be removed. Previously this had to be done mechanically. Various solutions were investigated in an attempt to develop a satisfactory chemical procedure. Cleanness of the sheet was evaluated by measuring sheet-to-sheet resistances. A satisfactory solution for sheet obtained from two manufacturers consisted of 10% CrO_3 containing 0.05% Na_2SO_4. 12 ref.

7-108. Polishing and Grinding Goes Modern. L. S. Sternal. *Metal Finishing*, v. 45, March 1947, p. 51-54.

Theories involved; construction and application of the various contact wheels; abrasive-belt grit sizes for given applications; future possibilities of the method.

7-109. Improved Barrel Plating Technique. Herberth E. Head. *Metal Finishing*, v. 45, March 1947, p. 55-57.

How Briggs Mfg. Co. solved problem of transferring work from barrels to baskets, and vice versa, as the work is moved from one bath to the next.

7-110. Finishing Copper by Oxidation With Sodium Chlorite. Walter R. Meyer and G. P. Vincent. *Metal Finishing*, v. 45, March 1947, p. 61-63, 71.

Oxide finishing of copper and its alloys by use of sodium chlorite and alkali. An immersion process, it not only prevents further oxidation of the surface, but acts as an excellent base for organic coatings due to the toothing of the surface caused by the oxidizing reactions. Pretreatment preparation of the metal and control conditions of the bath.

7-111. Electropolishing With Fluosulphonic Acid. (Concluded.) C. B. F. Young and Kenneth R. Hesse. *Metal Finishing*, v. 45, March 1947, p. 64-67.

Bath formulas and operating conditions for stainless and carbon steels. Life of baths; mechanism of polishing; economics of method.

7-112. Los Angeles Plating Plant Explosion. Fred A. Herr. *Metal Finishing*, v. 45, March 1947, p. 72-73, 107.

Explosion of perchloric acid, being used for electrolytic polishing of aluminum furniture, attributed to failure of the refrigeration system. Plant had been using a solution of perchloric acid and acetic anhydride.

7-113. Effect of Water Conditioning on Metal Finishing Operations. Robert S. Herwig. *Iron Age*, v. 159, March 27, 1947, p. 48-52.

An investigation to determine the effect on plating and cleaning cycles of hard water, softened water, and demineralized water. Among the advantages of using conditioned water are a reduction of drag-in, improved adhesion, elimination of sludge in hot alkaline baths, better finishes on burnished parts, easier rinsing of burnished parts, and more easily buffed deposits.

7-114. Tin as a Coating Material in the Wire Industry. Bruce W. Gonser. *Wire and Wire Products*, v. 22, March 1947, p. 207-210, 242-243.

Hot tinning; electrolytic tinning; replacement from aqueous solutions; replacement in molten salt; some unusual applications of tin coatings. 15 ref. (A paper presented before Wire Assoc. annual convention, Oct. 1946.)

7-115. Obstacle in Cleaning Drawing Compounds From Enameling Iron. W. H. Pfeiffer and V. A. Williamitis. *Journal of the American Ceramic Society*, v. 30, March 1, 1947, p. 90-94.

Under certain conditions of storage, some drawing compounds form a material on the surface of sheet enameling-iron parts which is insoluble in water and alkaline cleaners but is made soluble by organic solvents. Method of reproducing conditions necessary for the mechanism, and possible remedies.

7-116. Testing Resistance of Enameled Surfaces to Scratching, Gouging, and Abrasion. F. A. Petersen. *Journal of the*

(Turn to page 22)

Railroad Material Failures Teach Lessons From the Scrap Pile

Reported by Hans J. Heine
Metallurgist, Rockwell Mfg. Co.

Under the title "Lessons From the Scrap Pile—a Study of Railroad Material Failures", a veritably inexhaustible wealth of interesting metallurgical failures of railroad equipment was discussed and elucidated with the aid of numerous slides at the Pittsburgh Chapter's April meeting.

Charles B. Bryant, chief engineer, Technical Board of the Wrought Steel Wheel Industry, and recently of the Southern Railroad Co., was the featured speaker at the chapter's annual Young Fellows Night. J. W. Price, Jr., assistant metallurgical engineer of railroad materials and forgings, Carnegie-Illinois Steel Corp., was the discussion leader.

Most prominent among manufacturing defects, the speaker pointed out, are failures resulting from improper design and unsatisfactory material quality. To the latter group belong transverse fissures in rails (shatter cracks) which may cause serious accidents if they are allowed to remain undetected. Though controlled cooling is now universally adopted in the fabrication of rails, it may take another generation before all rails now laid are replaced. Insufficient cropping of the ingot may result in vertical split heads.

Often defects occur below the surface where the stresses are highest. Thermal cracks in certain grades of steel can be caused by welding. Tool marks left during faulty machining may lead to fatigue failures.

Continuous braking of trains in mountainous sections may liberate enough frictional heat to cause thermal cracks in the wheel treads.

Spinning of locomotive wheels on the track may cause incipient transformation of the rail steel (0.65 to 0.75% C) with subsequent thermal cracking, caused by immediate quenching of the heated areas because the generated heat is conducted away by surrounding cool sections of rail.

Hot boxes may cause fatigue failures of axle journals. Mr. Bryant also mentioned instances of intergranular penetration of copper from the journal bearing material into the steel of the journal.

The speaker devoted some time to a discussion of methods employed by the railroads to avoid failures. Outstanding is the Sperry rail detector which works on the principle that the distortion of a magnetic field, set up by passing a current through the rails to be tested, can be picked up by searching units and registered on tape. The section of rail which is found to be defective and causes the distortion of the field is automatically painted white. Next in importance, according to Mr. Bryant, are magnetic particle inspection and supersonics.

Rear Admiral J. W. Ludwig, now an assistant professor at Carnegie Institute of Technology, was the coffee speaker and talked on "An Episode in Nonferrous Metallurgy in Japan During World War II". A plant visitation to Carnegie-Illinois Steel Corp.'s widely publicized Irvin Works preceded the dinner meeting.

Orchids are due G. M. Snyder and his committee for planning an outstanding "Young Fellows Night".

Tatnall Speaks at Los Alamos

Reported by James M. Taub
Group Leader, Los Alamos Laboratory

Los Alamos Chapter presented F. G. Tatnall, manager of research of the Baldwin Locomotive Co., as the speaker for the April meeting. Mr. Tatnall spoke on "Strain Gages and Testing Methods" and his enthusiasm for his subject plus his excellent presentation held his audience's interest well beyond the length of a regular meeting. His talk has been reported in previous issues of *Metals Review*.

The Reviewing Stand

EDITORS and publishers are perpetually curious about their readers—if they weren't, they wouldn't be in business long! They want to find out the reader's likes and dislikes, his pet peeves and prejudices, and of course they want posies as well as brickbats. In short, they want to think of these readers as personalities and not just classified names on a circulation statement. So what do they do but take a poll or get out a questionnaire (and try to see to it that they get a truer picture than the famous *Literary Digest* poll that said Roosevelt couldn't be re-elected!).

Now it has also just occurred to us that readers may be curious about their editors and publishers. Maybe they would like to know some of the reasons why we do some of the queer things we do, or why we don't do some of the things they think we ought. So that's the purpose of this column—to tell you some of the more intimate details behind our job and give you a chance to tell us something about yourselves.

You readers will remember that last January *Metals Review* suddenly came out in an entirely new size and shape, a different format, a cover layout, a table of contents page, and two whopping feature articles. Well, we didn't do this because the old way was getting tiresome and we thought it would be fun to make a change, or because we wanted more work to do, or because we thought you didn't have enough to read. We did it because we found out that these were the things you wanted.

It all started last summer when many of you received a postcard with a few questions on it. In fact, there were only five short questions in all, but after weeks of analysis, study and interpretation, we came up with some interesting conclusions, and in January we came out with what almost amounted to a new publication.

What these questions were, what the replies said, and what they meant to us will be discussed in detail in subsequent issues of this column. It will also provide space for you to air some of your own ideas about what's right and what's wrong with us—or to disagree with anything we print, for that matter. Meanwhile, perhaps some of you can help us in our "questions we can't answer" department (see below).

Questions We Can't Answer Department

One of our readers wants to buy a machine for sifting and mixing carburizing compounds. Sifting machines he can get, but he doesn't know where to buy one that combines the two operations of sifting the used compound and mixing in fresh. Neither do we. Do you?

Another man wants to buy a quenching tank for production heat treating, cooled by water running through tubes in the oil. The tank should be 3x3x3 ft. and should have an overhead support for lifting out parts. Anybody want to make a sale? M. R. H.

American Ceramic Society, v. 30, March 1, 1947, p. 94-104.

Seven types of cover-seat enamels were tested for resistance to scratching, gouging, and abrasion by various methods. Chemical durability and reflectance were found to have little or no correlation with the resistance of the enamels to abrasion. Bubble structure of the layer seemed to have the greatest effect. 66 ref.

7-117. Aluminum Coated Steel. *Steel*, v. 120, March 31, 1947, p. 80-81, 102, 104.

Aluminum coated steel combines the surface characteristics of aluminum with the mechanical and physical properties of steel. Properties, finishing, and brazing.

7-118. Maintenance Metallizing. Gilbert C. Close. *Modern Machine Shop*, v. 19, April 1947, p. 136-138, 140, 142, 144, 146, 148, 150-151, 154, 156, 158, 160, 162, 164.

Latest developments in the field of metallizing. Metallurgical characteristics of sprayed metal. Four methods of surface preparation prior to metallizing. Best technique for the application of spray metal.

7-119. Metallization With Aluminum. C. R. Draper. *Light Metals*, v. 10, March 1947, p. 124-160.

An exhaustive study of all current techniques and equipment for the coating of metallic and nonmetallic bases with aluminum. Theory and practice with particular respect to the scope and economics of various fields of application. 41 ref.

7-120. Continuous Hot Galvanizing of Strip. E. A. Matteson. *Iron and Steel Engineer*, v. 24, March 1947, p. 61-62; discussion, p. 63-66.

Advantages of the continuous process over the separate-sheet process with additional information concerning the former.

7-121. Submerged Combustion in Industry. Walter George See. *Iron and Steel Engineer*, v. 24, March 1947, p. 90-94; discussion, p. 95-96.

Advantages of submerged combustion for the heating of pickling solutions. In commercial units both gas and air are forced to a burner below the surface of the liquid. When the burner is purged of liquid, the gas is automatically ignited, and the products of combustion are conducted along the bottom of the tank. There, they are vented through suitable holes, providing both agitation and heating.

7-122. Infrared Drying of Paint Materials. Raymond C. Adams. *Industrial Finishing*, v. 23, March 1947, p. 32-34, 36, 38.

Why drying setup must be properly adjusted to baking materials (and vice versa) to give results that will be economical and satisfactory, and why some infrared drying setups do not give the results that are expected.

7-123. Flock Finishing in a Custom Shop. J. Donald Bostrom. *Industrial Finishing*, v. 23, March 1947, p. 41-42, 44, 46, 48, 50, 52.

What kinds of adhesives and flock are available; their respective characteristics and merits; and the technique of applying them effectively.

7-124. The Ford Finish. E. M. Buell. *Industrial Finishing*, v. 23, March 1947, p. 60-64, 66, 68, 70.

The chief features of Ford system and setup for preparing surfaces, applying the finish, and baking the finish on Ford and Mercury automobiles.

7-125. Preweld Cleaning. W. J. Campbell. *Steel*, v. 120, April 7, 1947, p. 96, 138, 140, 142.

A few first-hand experiences on cleaning before welding. Mechanical and chemical methods generally used.

7-126. A Surface Active Agent for the Cleaning of Metals. O. M. Morgan. *Monthly Review*, v. 34, April 1947, p. 430-441.

Experimental methods and results of semi-quantitative test for evaluation of metal-cleaning compounds, using Nacconol NR.

7-127. The Electrolytic Polishing of Carbon-Manganese Steels. W. A. Sparks. *Journal of the Electrodepositors' Technical Society*, v. 21, 1946, p. 245-264. (Reprint.)

A series of experiments to obtain a process capable of being operated on a commercial scale with a minimum of technical control over the variables. Effects of various addition agents and the choice of steels.

7-128. Surface Treating Aluminum With Alodine. *Modern Metals*, v. 3, March 1947, p. 23.

Principal methods now used to protect aluminum and the advantages of Alodine over other coatings.

7-129. Preparation of Metals for Painting. R. E. Gwyther. *Corrosion and Material Protection*, v. 4, March-April 1947, p. 8, 10-11.

Cleaning methods; chemical treatments for iron and steel; preparing structural steel; zinc; aluminum; magnesium. (Presented at a Symposium on Modern Metal Protection, held jointly by the local sections of American Chemical Society, American Institute of Chemical Engineers, and The Electrochemical Society.)

7-130. A New Zinc-Base Finish for Steel Parts. J. A. Williams. *Materials & Methods*, v. 25, March 1947, p. 94-96.

Three operations required to achieve the zinc-base finish which is harder, and which provides greater protection against rusting than the previously used tin finish. First, the steel refrigerator parts are zinc plated to a thickness of from 0.0003 to 0.0005 in. Next, the zinc plated parts are treated in Anozinc Clear to form a corrosion-resistant coating. Finally, the shelves or other steel parts are coated with a clear-baking synthetic to provide increased abrasion resistance.

7-131. Stove Polishes. Robert L. Stetson. *Soap and Sanitary Chemicals*, v. 23, March 1947, p. 133, 135, 137, 139.

Besides the well-known use for domestic cast-iron ranges, these polishes are used to protect iron and steel airplane engine parts from corrosion. Formulas for material. 16 ref.

7-132. Surface Treatments for Magnesium Alloys. (Conclusion.) Rick Mansell. *Organic Finishing*, v. 8, March 1947, p. 31-33, 36-40.

Various chemical processes, electrolytic treatments, pickling, and anodic treatment.

7-133. Metal Preparation for Porcelain Enameling With a New Type Spray-Cleaning and Pickling Machine. George Tuttle. *Finish*, v. 4, April 1947, p. 19-22, 56.

Mechanical details and processing data from equipment now in operation.

7-134. The Properties of Porcelain Enamel and Their Effect Upon Enamelware. Part II. H. D. Carter, B. W. King, and H. C. Draker. *Finish*, v. 4, April 1947, p. 23-28, 56.

The effects of various conditions and the combined effects of thickness and expansion.

7-135. Production Clinic for Finishing Die Castings. *Die Castings*, v. 5, April 1947, p. 56-57.

Chemical treatments for zinc-base die castings; cleaning magnesium die castings; difficulties that may be encountered in buffing aluminum die castings.

7-136. Sur une Méthode de Polissage Electrolytique Accélére. (A Method of Accelerated Electrolytic Polishing.) L. Chamagne, H. Granjon and A. Leroy. *Métaux & Corrosion*, v. 21, June 1946, p. 73-80.

A new method for aluminum, magnesium and similar alloys is proposed. Using a much higher voltage up to 160 volts, polishing is completed in 20 sec. The installation and the method of operation. Jacquet's perchloric acid, acetic anhydride solution was used.

7-137. Organic Finishes for Increasing the Life of Bus and Truck Parts. Roy B. Davis. *Society of Automotive Engineers Preprint*, 1947, 7 p.

The nature of the metal to be finished, the conditions of exposure, and the treatment given the metal prior to painting. Metals concerned are steel and aluminum alloys, with brief reference to zinc die castings, zinc-plated sheets, and magnesium alloys.

7-138. High-Solids Metal Lacquers. J. K. Speicher. *Canadian Chemistry and Process Industries*, v. 31, March 1947, p. 214-217.

Various methods used to increase the solids content of lacquers, thus reducing the amount of solvent required. Data are presented concerning resins which, in combination with nitrocellulose, give low viscosity solutions, and which can be used in high proportions relative to nitrocellulose and still give durable lacquers. Results of 2-year outdoor-exposure tests.

7-139. Production Control Formulas for the Tinning of Steel Sheets. J. H. Mort. *Sheet Metal Industries*, v. 24, March 1947, p. 521-530.

A series of formulas relating to production on the various types of coating machines now employed.

7-140. Some Observations on Mottled Tinplates. A. Hamelain. *Sheet Metal Industries*, v. 24, March 1947, p. 543-546, 548.

The characteristic pattern of the alloy layer and the mode of occurrence of the pattern. Experiments were made on an Aetna-type tinning machine equipped with grease-pot brushes, and an old type of machine equipped with troughs below the rollers. Reagent used for selective removal of the free-tin coating was that described by J. C. Jones in *Sheet Metal Industries*, Oct. 1931.

7-141. Infrared Drying. J. D. Keller. *Industrial Heating*, v. 14, April 1947, p. 568-570, 572, 574, 576, 578, 580, 582, 584.

Convection drying; equipment available for infrared drying; radiant gas burners; efficiency of gas burners; circulation as an aid to drying; and dryer design.

7-142. Finishing Operations at Chrysler's Dodge Division. Bryant W. Pocock. *Products Finishing*, v. 11, April 1947, p. 30-32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58.

Spraying of paint and its attendant operations. Specifications for all Dodge plating solutions.

7-143. Proper Drainage of Metal Parts. John E. Hyler. *Products Finishing*, v. 11, April 1947, p. 78, 80.

A special conveyer-type washing, rinsing, and rustproofing machine, developed for cleaning and draining cup-shaped parts.

7-144. Water Soluble Buffing Compound May Offer Advantages. *Products Finishing*, v. 11, April 1947, p. 92, 94, 96.

New type buffing compounds contain no grease, tallow, stearates, stearic acid, or paraffin wax. Specialized materials give correct amount of tackiness for easy application to the buffing wheel. Because of the ease of removal without attack on base metal, the water-soluble buffing compounds are said to be particularly useful in finishing operations involving zinc-base die castings, aluminum, and brass.

7-145. Efficient Tooling Increases Production of Soleplates. James R. Logan. *Machine and Tool Blue Book*, v. 43, April 1947, p. 242-245.

Method of polishing and buffing soleplates.

7-146. Chemical Finishes Applied to Metals. *Machine and Tool Blue Book*, v. 43, April 1947, p. 254-256, 258-260.

Oxidizing method of preventing rust and corrosion. Recommended practices, principles, problems, and a few words of caution.

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Industrial Growth of West Coast Reflected in Success of Western Metal Congress

That the West Coast area has become (in the words of the local chambers of commerce) "a new opportunity-packed industrial empire" was indubitably proven by the Western Metal Congress and Exposition held in Oakland, Calif., the week of March 22. Evidence to support this statement is contained in the following facts:

That attendance, instead of the optimistically predicted figure of 55,000, reached a clocked total of 91,022 at the end of the six days of the exposition.

That the number of exhibiting firms increased rapidly before the opening of the show from an expected 165 to 200—about a third of them being West Coast plants.

That $750,000 worth of machines and equipment, much of it hauled long distances from eastern plants, was installed and operating to demonstrate products and processes in every phase of the metal industry.

That notables who attended the Congress included Governor Earl Warren and Senator Nolan; Henry Kaiser, whose firm exhibited in a Metal Congress for the first time; the national officers of the American Society for Metals, the American Welding Society, and the American Foundrymen's Association; and most of the leading technical lights of the metal industry throughout the country.

That, besides the celebrities, thousands of researchers, shopmen, engineers, scientists, and laboratory technicians, came to work, study and learn.

In addition to the knowledge of new methods and techniques gained from the exhibits, solid fundamental learning was provided by the 75 lectures presented on the sessions of the A.S.M., the Welding Society and the Foundrymen's Association. Lectures were mainly fundamental and educational in nature, yet they did not fail to include news of the latest pioneering investigations made by the researchers.

Highlight of the A.S.M. program was President Boegehold's Golden Gate Lecture (the only evening technical session), which consisted of his now famous exposition of hardenability. National Trustees Chipman, Jominy, Work, and Focke gave lectures on their specialties, and past presidents were represented on the technical program by C. H. Herty, Jr., A. H. d'Arcambal, and K. R. Van Horn.

Many of the displays at the exposition were typical of the industrial West's conversion from war-making equipment to peacetime products. Henry Kaiser's Permanente Products Co. exhibited a galaxy of aluminum products made by West Coast manufacturers, and revealed that four Kaiser plants are supplying light metals to 1000 manufacturers. Much interest was aroused (and not a few sales made) in Vacu-Blast Co.'s device for cleaning metal or stone surfaces.

Some of the West Coast Men Who Had an Active Part in the Western Metal Congress and Exposition. Left is William Hulse of General Metals Corp., a member of the Exhibit Committee; center, George Nelson of Shell Development Co. and J. A. Kies of Western Regional Laboratories, who presided as chairmen at two of the technical sessions; and, right, Earl R. Parker of University of California, who lectured on powder metallurgy

Giant of the exposition was Enterprise Engine and Foundry Co.'s huge marine diesel engine. Victor Equipment's demonstration of the Oxyarc cutting process drew large crowds, as did Air Speed Tool Co. with a new high-speed self-contained pneumatically operated saw and file tool.

Other important Coast exhibitors were Howard Foundry Co., which has recently opened a Los Angeles plant for production of large nonferrous castings; Acme Associates, manufacturers of a paint spray booth; General Metals Corp., which six months ago expanded into brass and bronze castings, as well as ferrous; and Joseph T. Ryerson & Son, which is coming out with a huge new plant in the Bay area.

The mutual benefit accruing from the Congress and Exposition to the metal industry and the western industrial area is reflected in the commendation voiced by Harold D. Weber, general manager of the Oakland Chamber of Commerce. "Not only was the event a fine thing for the community", he said, "but it offered us an opportunity to become better acquainted with many outstanding and important industrialists. Consequently, I think that both Oakland and the Oakland Chamber of Commerce, as well as those participating in the exposition, all derived much benefit from the Metal Congress."

Henry J. Kaiser (Left) and Frank Shackelford of Permanente Products Co. Examine One of the Many Aluminum Parts Made on the West Coast and on Display in the Permanente Booth at the Western Metal Exposition

7-147. The New Dilute Cronak Process. Michael H. Bruno. *Modern Lithography*, v. 15, April 1947, p. 51, 79, 81.

How the Cronak process converts the surface on zinc electroplates to an inert substance which does not corrode. Dilute Cronak is a modification which produces a much lighter color and uses only one-tenth the amount of bichromate. Technique of the process.

7-148. Some Observations on Chipping and Scarfing Operations. Ralph D. Hindson. *Blast Furnace and Steel Plant*, v. 35, April 1947, p. 439-442.

Pickling; defects encountered, and their general causes; and chipping.

7-149. Providing a Quality Paint Finish for the Old as Well as the New. *Enamelist*, v. 24, April 1947, p. 5-9, 36.

Paint system of continuous type divided into three main units: cleaning and rustproofing, painting and baking units.

7-150. Malleable Finishing. Earl Strick. *American Foundryman*, v. 11, April 1947, p. 96-99.

Hard iron cleaning; hard iron inspection; determining grinding method; skill and equipment required; die design and construction; final inspection.

7-151. Infrared Finishing Ovens. Ira J. Barber. *Paint, Oil & Chemical Review*, v. 110, April 3, 1947, p. 8, 16, 42.

The principles and applications of the above ovens for drying and baking of finishing materials.

7-152. Preparation of Metals for Painting. A Review. R. E. Gwyther. *Corrosion*, v. 3, April 1947, p. 201-207.

How to prepare the different common metal surfaces and the results of failure to remove scale before painting.

7-153. Clean Rinsing After Metal Cleaning. L. W. Collins. *Industrial Finishing*, v. 23, April 1947, p. 35-36, 38.

Causes of poor rinsing and the final results; a typical example of the effects of poor rinsing encountered in a repair and maintenance shop of a vending-machine service company and the practical remedy suggested. Desirable features of spray rinsing.

7-154. Modern Equipment for Finishing Scales. P. E. Stonehouse. *Industrial Finishing*, v. 23, April 1947, p. 57-60.

How modern equipment adapted to the product and the work is used effectively and economically.

7-155. Rolling a Color Coat on Metal Sheets. Joseph Mihalko. *Industrial Finishing*, v. 23, April 1947, p. 63-64, 66, 68, 70.

How a uniform coat of enamel is applied to sheet metal stock by means of roller-coating machines. Metal sheets are run through and coated one side at a time.

7-156. A New Process for Electropolishing Silver. Daniel Gray and S. E. Eaton. *Iron Age*, v. 159, April 10, 1947, p. 64-65.

Process employs a current in a direction opposite from that employed in normal plating, is performed in an alkaline cyanide bath without removing the parts from the original plating racks, and results in a complete polish up to mirror brightness.

7-157. New Phosphating Tunnels Installed at Ford. Herbert Chase. *Iron Age*, v. 159, April 10, 1947, p. 82-84.

Application of phosphate coatings on an assembly-line basis in two spray tunnels. Data on the processing steps, method of handling solutions, and sludge and pumping equipment.

7-158. Silicon Monoxide for Hardening Metal Films. *Iron Age*, v. 159, April 17, 1947, p. 49.

A new technique for creating a metal surface having 100 times normal hardness with no change in reflectivity.

7-159. New Production Machine Automatically Coats Cylinder Block Cores. *Automotive and Aviation Industries*, v. 96, April 15, 1947, p. 39.

Machine automatically coats V-8 cylinder blocks and cores with a protective material. Consists of a moving conveyer, dipping tank, and spinning fixture. Sand cores, secured on the conveyer in pairs, are carried through the dipping tank containing the coating compound, and then spun to remove excess coating compound.

For additional annotations indexed in other sections, see:
3-108; 6-72; 9-45; 20-170-193; 22-187-214; 23-118; 25-48; 27-70.

8 ELECTROPLATING

8-41. Electroplating Zinc-Base Die Castings. C. F. Nixon. *Metal Finishing*, v. 45, March 1947, p. 58-60.

Polishing, buffing, cleaning, plating, and stripping of zinc-base die castings and techniques for improving surface conditions. Methods used to finish hardware; experimental work.

8-42. Measurement of Current in Electrolytic Baths. B. A. Novikov. *Engineers' Digest (American Edition)*, v. 4 March 1947, p. 101.

A new measuring instrument and technique for determining the current distribution in electroplating baths. (Condensed from *Promyshlennaya Energetika*, no. 6, 1946, p. 9-10.)

8-43. Plating on Aluminum. R. A. Ehrhardt and J. M. Guthrie. *Monthly Review*, v. 34, April 1947, p. 421-428.

A study of the zincate solutions with test procedure and results.

8-44. Porosity of Electrodeposited Metals. A.E.S. Research Project No. 6. Part I. Bibliography. N. Thon and E. T. Addison, Jr. *Monthly Review*, v. 34, April 1947, p. 445-453.

Only references which bear directly on the porosity aspect in corrosion. Bibliography is arranged chronologically and, for each year, in the alphabetical order of authors' names.

8-45. Determination of Impurities in Electroplating Solutions. A.E.S. Research Project No. 2. Part VI. Traces of Copper in Nickel Plating Baths. Earl J. Serfass and W. S. Levine. *Monthly Review*, v. 34, April 1947, p. 454-461.

Development work and procedures for colorimetric method for determination of very small amounts of copper in nickel-plating baths. Details of procedure not requiring a colorimeter.

8-46. Effect of Small Amounts of Zinc in Watts Type Nickel Depositing Solutions. G. E. Gardam. *Journal of Electrodepositors' Technical Society* (Reprint), v. 22, 1947, p. 8-13.

Not only do small traces of zinc interfere with nickel deposition but the ratio of zinc to nickel in the deposit is greater than in the solution. A number of experimental results.

8-47. Note on the Effect of Copper on Nickel Deposition. G. E. Gardam. *Journal of Electrodepositors' Technical Society* (Reprint), v. 22, 1947, p. 14.

Method used to determine the maximum amount of copper which can be used in nickel anodes without causing porous deposits. This amount was found to be 0.13 to 0.17%. Method used for determination of copper in Watts plating solution.

8-48. Method of Analysis of Chromium Plating Solutions. F. W. Salt. *Journal of Electrodepositors' Technical Society* (Reprint), v. 22, 1947, p. 15-18.

Estimation of chromic acid, trivalent chromium, and iron—including sulphuric acid, may be completed in about 1½ hr. in method described. By using oxidation-reduction indicators the inconvenience of an additional unstable reagent (potassium permanganate) is avoided. Sodium N-phenyl-anthranilate is used instead of barium diphenylamine sulphonate as indicator for the chromic acid and trivalent chromium determinations because it gives a more striking end-point, and the addition of phosphoric acid is unnecessary.

8-49. Estimation of Nickel, Cobalt, Chloride, Formate and Formaldehyde in Nickel-Cobalt Plating Solutions. F. W. Salt. *Journal of Electrodepositors' Technical Society* (Reprint), v. 22, 1947, p. 19-21.

Methods of estimation of the principal constituents of a widely used bright-nickel electroplating solution which are entirely volumetric. Boric acid does not interfere. Where applicable the individual methods can be used for other nickel plating solutions.

8-50. Electro-Tinplate. Part II. The Influence of Coating Thickness on the Porosity and Resistance to Corrosion of Electro-Tinplate. Part III. The Influence of Pickling Conditions on the Porosity and Corrosion Resistance of Electro-Tinplate. K. W. Caulfield, R. Kerr and R. M. Angles. *Journal of the Society of Chemical Industry*, v. 66, Jan. 1947, p. 5-11.

In Part II, study was made of effect of variation in coating thickness on quality of electro-tinplate deposited from stannous sulphate and sodium stannate baths. Curves show influence of coating thickness on thiocyanate, hot-water porosity, humidity, and salt-spray test values, and effect of time of exposure out of doors on weight increment for a range of coating thicknesses. In Part III, quality of coatings from alkaline and acid baths as determined following different pickling treatments. Inhibited sulphuric acid found to be best for alkaline bath deposits; and anodic etching in sulphuric acid was best for the acid-bath type.

8-51. The Control and Maintenance of Electroplating Solutions. Part II. (Continued.) P. Berger. *Sheet Metal Industries*, v. 24, March 1947, p. 593-597.

Nickel solutions—their control and maintenance, and solution troubles. (To be continued.)

8-52. Metallography for the Electroplater. Alex Blazy and J. B. Mohler. *Metal Finishing*, v. 45, April 1947, p. 54-57.

Techniques in metallography for the examination of electroplated coatings. Equipment necessary for this type of work. An explanation of microscopic methods of interpreting electrodeposited coatings. Tables list the necessary etching reagents for the common metals and alloys, together with directions for their use.

8-53. Rectifiers for Electroplating. Part II. Louis W. Reinken. *Metal Finishing*, v. 45, April 1947, p. 58-62.

Continuously variable auto-transformer control; motor-driven variable auto-transformers; advantages and disadvantages; rectifier construction; importance of ventilation; remote and local control; rectifier capacities.

8-54. Fusing of Electrodeposited Tin Coatings. J. Falk. *Metal Finishing*, v. 45, April 1947, p. 63-65, 71.

Simplified method of obtaining extremely lustrous electroplated tin finishes by fusing of thin coatings. Equipment necessary to perform this operation and control conditions. Fused electroplated tin coatings give not only brilliance but theoretically have higher corrosion resistance because of less porosity than that of a nonfused coating.

8-55. Determination of Free Sodium Hydroxide and Sodium Carbonate in Plating Solutions. Louis Silverman. *Metal Finishing*, v. 45, April 1947, p. 72-73.

Reagents and procedure.

8-56. Brass Plating; Routine Chemical Control. H. E. Zentler-Gordon and E. R. Roberts. *Metal Finishing*, v. 45, April 1947, p. 66-69.

The analytical methods in present-

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"Serviceability Factors" in Selection Of Steel Can Be Reliably Estimated

Reported by G. F. Kappelt
Assistant Metallurgist, Bell Aircraft Corp.

Although desired tensile strength is the prime factor upon which alloy steels are selected and heat treated, the dependent qualities of yield strength, ductility, and toughness, as well as tensile strength, are governed largely by the degree to which a fully martensitic structure is obtained in quenching. In his talk on "Selection of Heat Treating Alloy Steel", Walter Crafts, chief metallurgist of the Union Carbide and Carbon Research Laboratories, told the members of the Buffalo Chapter that the initially 100% martensitic structure is an ideal that is obtained in production heat treatment only in a limited number of applications of alloy steel.

To qualify the selection of alloy steels, the serviceability factors, tensile strength, yield strength, elongation, reduction of area, and impact strength must be considered. These serviceability factors can now be calculated or estimated with a useful accuracy, according to Mr. Crafts, from the composition of the steel and the manufacturing technique employed, even though the original quenched structure is not entirely martensitic. The principle of equivalent substitution of alloys in partially hardened alloy steels was said to be more true with respect to serviceability factors than for the fabricating factors, such as machinability and distortion.

Incomplete hardening will cause the yield strength to decrease regularly from about 90% of the tensile strength to the neighborhood of 60% if the tempering temperature is high enough to permit stress relief. At lower tempering temperatures the proportional limit may be very low and unpredictable on account of residual stresses.

Reduction of area for a given tensile strength depends on hardenability and tempering temperature as well as on quality factors that become more critical as the carbon content becomes higher. Above 0.30% carbon the reduction of area becomes quite difficult to predict and control.

Impact strength of partially hardened alloy steels can be reliably predicted under controlled conditions. Some factors, such as directional properties, temper brittleness, and lack of sufficient alloy content to assure consistent hardening, limit the applicability of the calculation of impact strength. However, if these production factors can be controlled, it is possible to make a close estimate of the needed degree of hardenability and thereby make a rational and economical selection of alloy steel.

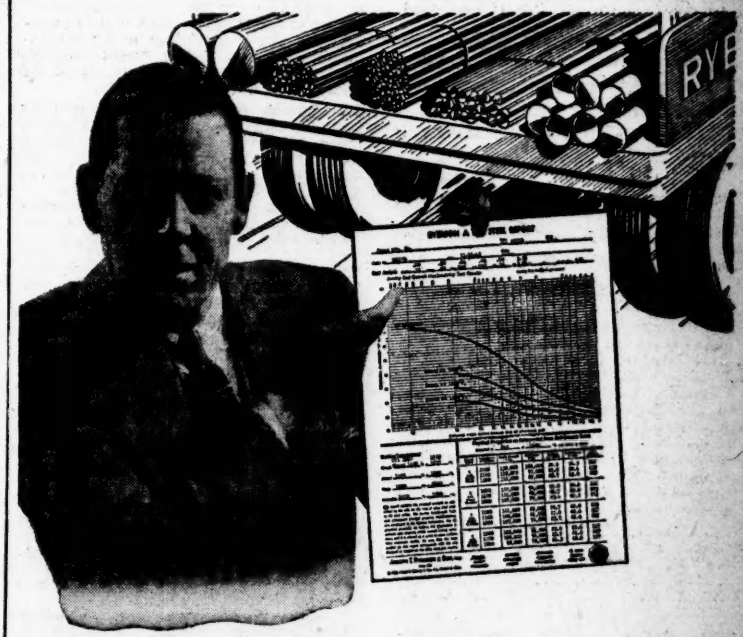
Tri-State Meeting Revived All-Day Session Planned

New Jersey Chapter will be host to the New York, Philadelphia, Lehigh Valley and York Chapters on May 23, when the annual Tri-State Meeting of these chapters, discontinued during the war, will be revived.

M. A. Grossmann

An all-day meeting is planned. At the morning session Peter Payson will speak on effect of alloys in steel, Francis B. Foley on high-temperature alloys, and B. F. Shepherd on the P-V test for hardenability. National Secretary Eisenman will present greetings from the national office at the luncheon and M. A. Grossmann, past president and director of research, Carnegie-Illinois Steel Corp., will conduct the afternoon session, speaking on "Toughness and Fracture of Hardened Steels".

Dinner speakers are National President A. L. Boegehold and H. N. Davis, president of Stevens Institute of Technology, whose subject is "Today's Challenge to the Engineer".



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8-57. Common Industrial Electroplates, Part II. Nonferrous Base Metals. P. W. Prouty. *Product Engineering*, v. 18, April 1947, p. 155-158.

Applications and limitations of different plates for nonferrous base metals such as copper, brass, and bronze. Plating with such metals as tin, nickel, and silver; plating on zinc die castings and aluminum parts. Summary of general plating practice shown on a chart.

8-58. Precision Plating of Bearing Alloys. R. A. Schaefer. *Iron Age*, v. 159, April 10, 1947, p. 60-63.

Development of methods for precision plating of bearing alloys, which compete with present commercial casting processes and are equivalent or superior in performance because of the added advantage of more accurately controlled mechanical dimensions of the bearing materials. Fundamentals of trimetal bearings, and data on plating procedures for both ferrous and nonferrous bases, bath compositions, and rack design.

For additional annotations indexed in other sections, see:
7-113-114; 10-59; 11-37; 25-47; 27-76-78.

9 PHYSICAL TESTING

9-40. Fatigue Tests as Criterion of the Weldability of Sheet. R. L'Hermite, D. Seferian and F. Canac. *Materials & Methods*, v. 25, March 1947, p. 128-129.

Tensile and fatigue tests were made on chromium-molybdenum steel containing 0.17% carbon, 0.45% manganese, 1.05% chromium, 0.34% molybdenum and 0.32% nickel. Tests were made on sheet as furnished and after welding with a mild-steel rod. Mean tensile strength as welded was 90% of that of the parent metal, the elastic limit 95%, the elongation 35%, and the endurance limit in repeated bending 73%. Specimens with the best surface had the highest endurance limit, although the reverse did not apply. (Condensed from *Inst. Tech. du Vatiment et des Travaux Publics, Circulaire*, Series G, No. 14, Oct. 15, 1946, 28 p.)

9-41. Static and Fatigue Tests of Arc Welded Aluminum Alloy 61S-T Plate. E. C. Hartmann, Marshall Holt and A. N. Zamboky. *Welding Journal*, v. 26, March 1947, p. 129s-138s.

Preliminary information on the static and fatigue strength of metal-arc welded joints of the above alloy with different specimen designs. Experimental procedures, and results.

9-42. Measuring Microhardness by Indentation Tests. E. S. Greiner. *Bell Laboratories Record*, v. 25, March 1947, p. 104-107.

Various techniques described.

9-43. Westinghouse Uses New Jet Metal Test. *Aviation News*, v. 7, March 1947, p. 18.

New test method for high-strength heat-resistant alloys required for jet engines. Disks 1 ft. in diameter, and 1 in. thick are rotated at 35,000 r.p.m. while being heated to 1400° F. This is continued until the disk flies apart.

9-44. The Notched-Bar Impact Test According to Schnadt. J. A. Haring. *Engineers' Digest (American Edition)*, v. 4, March 1947, p. 103.

In test bar developed by Schnadt, a hole is drilled in the compression zone opposite the notch, and a loosely fitting hardened steel pin inserted. This procedure is claimed to give more satisfactory results since work is not expended in deformation of material in the compression zone, which deformation is not present in the case of brittle fracture. (Condensed from *De Ingenieur*, v. 58, Dec. 13, 1946, p. 15-17.)

9-45. Abrasion Resistance Analysis of Organic Coatings. Arthur P. Schulze. *Organic Finishing*, v. 8, March 1947, p. 9-13, 15, 17.

The abrading instrument and five steps in analytical procedure: preparation of specimens; refacing abrading wheels; mounting test panel on tester; performing the test; calculation of numerical wear factor.

9-46. Le Role de l'Etat de Surface dans les Mesures de Dureté. (Influence of the State of Surface on Hardness Testing.) P. Bastien and A. Popoff. *Revue de Métallurgie*, v. 42, Dec. 1945, p. 373-388.

In hardness determination using low loads, two cases are considered: determination without regard to the state of the surface or application of methods resulting in data which characterize the geometrical and physicochemical state of the metal surface. Testing equipment and methods of operation for these two cases.

9-47. Analise do Métado de Ensaio de Dureza Rockwell—Aplicacoes. (Analysis of the Rockwell Method of Hardness Determination.) E. Orosco. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 3-38.

Attempts to establish experimentally a relation between different test conditions and the corresponding Rockwell numbers. A new concept, "sensitivity" of the test, is introduced which permits comparison of test data, using diamonds, cones, and balls of different diameters. 16 ref.

9-48. Stress-Rupture Tests of 5% Chromium Steels With Molybdenum and Titanium. George F. Comstock. *Metal Progress*, v. 51, April 1947, p. 610-611.

Questions the validity of information concerning the high-temperature strength of 5% Cr (Mo + Ti) steels, reported by C. L. Clark in December 1946 issue. Mr. Clark's reply is included.

For additional annotations indexed in other sections, see:
3-106-112; 7-116; 12-62; 18-61; 22-163-219-220-223; 24-104; 27-83.

10 ANALYSIS

10-55. Methode de Dosage du Cobalt. (Methods of Determination of Cobalt.) Jules Lamure. *Bulletin de la Société Chimique de France*, Nov-Dec. 1946, p. 661-663.

The formation of cobalt mercurithiocyanate is used for determination of bivalent cobalt.

10-56. Simple Derivation of the Limiting Current With the Dropping Mercury Electrode by Dimensional Analysis. Oscar Kanner. *Electrochemical Society Preprint 91-10*, 1947, 3 p.

Except for a numerical constant, the formula for the limiting current in polarographic analysis is derived in an elementary and simple way by means of dimensional analysis, illustrating the general usefulness of this method.

10-57. Polarographic Determination of Vanadium in Steel and Other Ferro-Alloys. James J. Lingane and Louis Meites, Jr. *Analytical Chemistry*, v. 19, March 1947, p. 159-161.

Method described is based on removal of interfering elements by electrolysis with a mercury cathode from a dilute sulphuric-phosphoric acid solution, and subsequent measurement of the anodic diffusion current produced by the oxidation of quadrivalent to pentavalent vanadium in a supporting electrolyte containing 0.5 to 3*N* sodium hydroxide and 0.1*N* sodium sulphite. Results obtained in analysis of ten Bureau of Standards samples were in excellent agreement with the Bureau's values. 11 ref.

10-58. Determination of Bismuth, Copper, and Lead in Aluminum Alloys. George Norwitz, Samuel Greenberg and Freda Bachtiger. *Analytical Chemistry*, v. 19, March 1947, p. 173-175.

Method described is much shorter than the method of the Aluminum Co. of America. Bismuth is determined colorimetrically as the iodide after precipitation as the oxychloride, and copper and lead are determined electrolytically from a nitric acid solution. 19 ref.

10-59. Apparatus for Anodically Stripping Electrodeposits From One Side of a Sheet for Analytical Purposes. J. W. Price. *Journal of Electrodepositors' Technical Society* (Reprint), v. 22, 1947, p. 22-23.

Apparatus devised to stop-off one side.

10-60. Om Elektriska Aggregat för Ljusalstring Vid Spektralanalys. (Spark and Arc Circuits for Spectrographic Analysis.) Georg Carlsson and Roland Rynninger. *Jernkontorets Annaler*, v. 131, no. 1, 1947, p. 1-23.

A survey of different electric circuits used in spectrographic analysis. The two main groups are thoroughly analyzed and illustrated. A source-unit developed in Sweden on the basis of the above indicated circuits. 29 ref.

10-61. The Determination of Small Amounts of Aluminum by the Aurintricarboxylate Method. N. Strafford and P. F. Wyatt. *Analyst*, v. 72, Feb. 1947, p. 54-56.

In a paper published in 1943, the authors described a method for small amounts of aluminum and iron in water. This method was found to be inaccurate for determination of small amounts of aluminum in organic compounds. Modifications in procedure which eliminated the difficulties are described.

10-62. Infrared Absorption Analysis of Gases and Vapors. R. Quarendon. *Petroleum*, v. 10, March 1947, p. 54-55, 57.

First installment of a six-part article consists of a general introduction covering theoretical considerations and a brief description of limited and total radiation analyzers. (To be continued.)

10-63. Spectrochemical Analysis of High Copper in Cast Iron and Steel. W. R. Kennedy. *Journal of the Optical Society of America*, v. 37, March 1947, p. 154-158.

A unique method which is suitable for copper in cast iron and steel up to 2.50%.

10-64. The Spectrochemical Analysis of Nickel Alloys. Edwin K. Jaycox. *Journal of the Optical Society of America*, v. 37, March 1947, p. 159-162.

A procedure for the analysis of nickel alloys for copper, iron, lead, magnesium, manganese, silicon, titanium, and zinc in the range 0.005 to 0.30% and for boron in the range 0.0003 to 0.03%.

10-65. A Study Concerning Characteristics of the High-Voltage A.C. Arc. E. A. Boettner and C. F. Tufts. *Journal of the Optical Society of America*, v. 37, March 1947, p. 192-198.

Investigation of eight factors and their effects on the reproducibility of intensity ratios of spectral lines when the high-voltage alternating-current arc is used as a source of excitation for quantitative spectrochemical analysis.

10-66. Slag Control by Routine Spectrographic Analysis. J. T. Rozsa. *Metal Progress*, v. 51, April 1947, p. 593-597.

Shows that above method will pre-

(Turn to page 28)

Speakers' Table at the February Meeting of the Syracuse Chapter (Left to Right): W. L. Hodapp, Chapter Secretary; W. A. Pennington, Treasurer; K. W. Robinson, Chairman; John D. Shaw, Principal Speaker; R. N. Gillmor, Vice-Chairman; F. F. Adkinson, Past Chairman; and M. Brace, Jr., and H. A. Johnson, Members of the Executive Committee

Wartime Research Aids Knowledge of Powder Metallurgy

Reported by R. N. Stenerson
Metallurgist, Carrier Corp.

Wartime research added much to our knowledge of powder metallurgy and gave impetus to the development of powder metallurgy parts, John D. Shaw stated in his address before the February meeting of the Syracuse Chapter. Mr. Shaw is assistant director of research, powder metallurgy laboratory, Stevens Institute of Technology, Hoboken, N. J.

Certain technological developments in powder metallurgy in Germany during the war were in advance of ours. For example, German iron powder production was about ten times greater than that of this country. Many important domestic applications of powdered metals parts made during the war cannot yet be divulged, but Mr. Shaw cited the development of projectiles with a core of tungsten carbide and pointed out that the armor-piercing ability of these projectiles is remarkably superior to other types.

New developments in powder metallurgy are rapidly expanding the scope of usefulness and application of powder metallurgy parts. According to Mr. Shaw, the use of pre-alloyed powders, instead of mixed primary powders, results in compacts of greater homogeneity and improved physical properties, and makes possible the production of alloy structures that cannot be made from primary powders. One method of producing pre-alloyed powders is by breaking down a molten stream of the alloy with a high speed jet of water. This process can be regulated so as to give good control of particle size and homogeneity.

The trend of new equipment is toward presses of greater capacity, equipped with multiple core rods, and generally capable of more complex movements and of longer strokes. The use of suitable equipment for hot pressing alloy powders will permit the preparation of a homogeneous metal structure with physical properties capable of competing with known metalworking techniques. The normal waiting period during which diffusion takes place is minimized and the time cycle for production of parts is materially reduced.

Physical Society Forms Division of Solid State

A Division of Solid State Physics in the American Physical Society is in the process of formation. Although the object of the division is not limited to metals, it is expected that most of its activity and meetings will be of close interest to metallurgists, primarily in the field of physical metallurgy.

First meeting of the division will be held in conjunction with the meeting of the American Physical Society in Montreal, June 19 to 21, 1947. It will take place on Saturday, June 21, so that those interested may also attend the American Society for X-Ray and Electron Diffraction starting Monday, June 23.

Four papers have so far been scheduled:

Diffraction of Neutrons in Crystals, by F. Seitz.

Theory of Crystal Rectifiers With Application to Copper Oxide, by J. Bardeen.

The Relaxation Spectrum of Metals, by C. Zener.

Nuclear Magnetic Resonance Absorption in Solids and Liquids, by E. M. Purcell.

The Organizing Committee of the Division of Solid State consists of T. A. Read, F. Seitz, W. Shockley, S. Siegel, R. Smoluchowski, and C. Zener.

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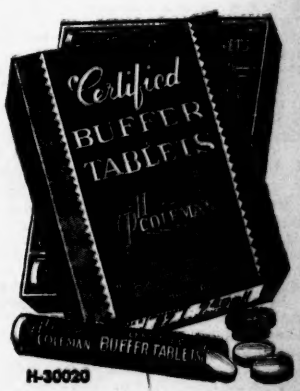

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vent three out of four of the expected off-analyses and high phosphorus heats. Direct-reading instruments enable analyst to make a complete steel or nonferrous analysis within two min., and a complete slag analysis in three min.

10-67. Setting-Up for Spectrographic Analysis. P. J. Gruszecki. *Iron Age*, v. 159, April 17, 1947, p. 44-46.

The fundamental concepts to be observed by a laboratory when installing a spectrograph unit. The effect of variation in barometric pressure in varying the slope of analytical curves is explored, substantiated with experimental data.

For additional annotations indexed in other sections, see:
8-47-48-49-55-56; **11**-40; **27**-69.

11 INSTRUMENTS Laboratory Apparatus

11-31. Mounting for Edge Examination. André Hone. *Metal Progress*, v. 51, March 1947, p. 435-437.

Method consists of coating the sample, prior to mounting in the conventional way, with a substance having sufficient penetrating power, adherence, hardness, and elasticity. Gives satisfactory results for aluminum and its alloys.

11-32. Spotting Iron Contamination on Stainless Surfaces. M. A. Scheil. *Metal Progress*, v. 51, March 1947, p. 442-443.

New method, first used to detect pinholes in nickel plating, using "ferroxyl" paper was adapted to the above purpose. Formation of Turnbull's blue spots indicates contamination.

11-33. Metallographic Techniques for Magnesium Alloys. P. F. George. *Aluminum and Magnesium*, v. 3, Feb. 1947, p. 11-13, 24-25.

Etchants, with their compositions, etching techniques, and uses for special metallographic techniques. The picric acid etchants change their etching characteristics in a few hours, and therefore cannot be made up in advance. However, the 5% picral solution can be made in advance and used as a stock solution in all the etchants containing picral.

11-34. Magnetic Detection of Ferrite in Incomplete Hardening. L. M. Baldina, M. V. Dechtjar, and A. M. Gorbunov. *Engineers' Digest (American Edition)*, v. 4, March 1947, p. 141.

Temperature differences in the hardening process for shafts of "40X" steel, which has a demagnetization factor of 0.18 (l/d = 10), have a marked effect on coercive force. Measurements of this force indicate the homogeneity of the material, which is an important factor in determining the quality of the product. (Condensed from *Zavodskaja Laboratorija*, no. 7-8, 1946, p. 692-799.)

11-35. X-Ray Scattering at Small Angles by Finely Divided Solids. Parts I and II. C. G. Shull and L. C. Roess. *Journal of Applied Physics*, v. 18, March 1947, p. 295-313.

Part I includes the general theory, calculation of scattered intensity curves and several procedures for obtaining a size distribution. Details of experimental techniques including general procedures for applying corrections for slit geometry. Scattering data, mass distribution curves, and average particle sizes for amorphous silica gels and for crystalline oxides of alumina, nickel and iron. Part II presents an exact theory for X-ray scattering at small angles by a continuous distribution of randomly spaced spheroidal particles having an arbitrary but fixed shape. 26 ref.

11-36. Théorie Electro-Chimique de l'Action des Réactifs Employés pour la Métallographie Microscopique des Fontes Grises Fondée sur l'Expérience. Application aux Fontes de Lingotières d'Aciéries. (Electrochemical Theory of the Action of Reagents Used for Microscopic Metallography of Gray Iron, Based on Experimentation. Application to Cast Irons for Steel Ingot Molds.) Louis-Fernand Girardet. *Fonderie*, no. 12, 1946, p.455-461; discussion, p. 461.

Seven types of experiments with various saline electrolytes and gray irons. Modifications of the ratio of anodic surface to cathodic surface. Application of this study to cast-iron ingot molds.

11-37. A New Time-of-Gassing Test of Thickness of Cadmium Coatings, Particularly for Small Parts. S. G. Clarke and J. F. Andrew. *Journal of Electrodepositors' Technical Society* (Reprint), v. 22, 1947, p. 1-7.

A nickel salt in concentrated hydrochloric acid has a strong equalizing effect on the rate of solution of cadmium coatings. Its use in a simple improved time-of-gassing method. Recommended for testing small articles, which are difficult or inconvenient to deal with by existing tests for average or local thickness of coatings.

11-38. Note on a Convenient Method of Electropolishing Aluminum Alloys. U. R. Evans and D. Whitwham. *Journal of Electrodepositors' Technical Society* (Reprint), v. 22, 1947, p. 24-28.

Method developed for the polishing of aluminum alloy sheet specimens in connection with corrosion research. Aim of experiments was the determination of the optimum conditions for polishing microsections.

11-39. The Application of Electrolytic Polishing to Ferrous Metallography. H. J. Merchant. *Journal of the Iron and Steel Institute*, v. 155, Feb. 1947, p. 179-194.

Effects of variable conditions of electrolysis when using Jacquet's perchloric acid, acetic anhydride electrolyte. The design of a suitable type of cell was investigated and five different cells were constructed. Electrolytic polishing is compared with mechanical polishing on the basis of procedure and results. Other potential solutions for electrolytic polishing were also investigated, and a list of recommended electrolytes is given. Various observations made in the course of this work are considered relative to the present theory of electrolytic polishing.

11-40. The Measurement of the Intensity Ratios of Spectral Lines With Electron Multiplier Phototubes. K. G. Kessler and R. A. Wolfe. *Journal of the Optical Society of America*, v. 37, March 1947, p. 133-144.

Some properties of electron-multiplier photo-tubes. The use of these tubes in quantitative spectrographic analysis is discussed, and a scheme for reducing the effect of dark current is described. An amplifier circuit for measuring the intensity ratios of spectral lines, and results of the application of this circuit to the analysis of chromium in steel.

11-41. Automatic Measurement of Sheet Metal Thickness by X-Ray. H. Seymour. *Petroleum*, v. 10, March 1947, p. 68-69.

The fluoroscopic-screen method first described by H. M. Smith of General Electric.

11-42. Optical Methods for Evaluation of Metal Surfaces. Arthur A. Vernon. *Metal Finishing*, v. 45, April 1947, p. 70-71.

Instruments now available for surface pictures; the reflection method.

11-43. Surface Roughness, Waviness and Lay. Part I. *American Machinist*, v. 91, April 10, 1947, p. 155.

Standard is concerned with the geometrical irregularities of surfaces of solid materials. Establishes definite classifications for various degrees of roughness and waviness, and for various varieties of lay. It deals only with their height, width, and direction.

11-44. Graphite Flake Type in Gray Cast Iron. *Metal Progress*, v. 51, April 1947, p. 616-B.

Standard charts of flake type and recommended procedure for determining flake size and type.

11-45. Metallographic Electropolishing. J. L. Waisman. *Metal Progress*, v. 51, April 1947, p. 606-610.

The mechanism of electrolytic polishing, the essential features of an electropolishing installation, and the factors entering into mechanical convenience. The installation and electrolytes used for the routine polishing of steels and aluminum alloys.

11-46. New Replica Techniques for Evaluating Engine Wear. *Automotive and Aviation Industries*, v. 96, April 15, 1947, p. 36-37, 78.

Two new replica methods of evaluating surfaces finishes of engine parts subject to wear. A National Bureau of Standards process is based on the use of a plastic replica which reproduces in minute detail the protuberances and recesses of a surface, and a photo-electric means of evaluation. The N.A.C.A. Aircraft Engine Research Laboratory method also uses a plastic replica, but the examination is made by a microscope.

For additional annotations indexed in other sections, see:
2-65; **5**-22; 8-42-52; **9**-45; **17**-33.

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12 INSPECTION AND STANDARDIZATION

12-59. Magnetic Particle Inspection of Chromium-Plated Tools. M. H. Mueller and W. E. Yeast. *Metal Progress*, v. 51, March 1947, p. 420-425.

How change in the equipment and technique of magnetic inspection, together with draws at 350° F. to relieve internal stresses, brought rejects down from around 50 to 0.5% in an epidemic of broken tools used in the manufacture of small arms ammunition.

12-60. Selecting Steels by Hardenability Bands. Charles M. Parker. *Materials & Methods*, v. 25, March 1947, p. 68-72.

Development of a method of selection on the basis of hardenability to overcome faults inherent in specifying steels according to chemical composition.

12-61. Installing a Quality Control Program. Norbert L. Enrick. *Materials & Methods*, v. 25, March 1947, p. 90-93.

Principles behind the establishment and operation of a quality control program that can be a useful guide in any metalworking plant. Master sampling tables show keystones around which quality control programs are built.

12-62. Radiography and the Fatigue Strength of Spot Welds in Aluminum Alloys. R. C. McMaster and H. J. Grover. *Welding Journal*, v. 26, March 1947, p. 223-232.

A large number of spot weld specimens, in which significant variables were controlled and specific welding conditions were varied, were provided to Battelle Memorial Institute by several West Coast aircraft manufacturers for the research described. 137 of these specimens were radiographed, then subjected to fatigue tests. Tentative conclusions concerning effects of different factors are given and further research is recommended.

(Turn to page 30)

Kennedy Compares Wartime Accomplishments In Materials by U.S., Germany and Japan

Reported by G. W. Birdsall

Manager, Technical Editorial Service
Reynolds Metals Co.

Richard R. Kennedy, chief metallurgist, Wright Field, Dayton, Ohio, made some extremely interesting comparisons in his talk on "American Vs. Foreign Materials" at the Feb. 4th meeting of the Louisville Chapter ASM.

One of the interesting wartime jobs described by Mr. Kennedy was the setting up of a list of equivalent British-American materials so that American planes and equipment could be repaired in British shops and vice versa. In examining materials for this project and in checking our uses against German and Japanese, it was found that all countries employed uniformly high quality materials, and there was a striking similarity in application of materials by the different countries.

The Germans—in contrast to the Japanese—did an excellent job of selecting materials and designing and engineering parts. They developed a code system whereby a series of numbers on each individual part told the type of steel, chemical composition, heat treatment, and often even the plant in which it was made.

The different countries met the shortages of materials and critical alloying elements in different ways. The United States supply of alloying elements was extended greatly by development of the N.E. steels and the hardenability method for evaluating substitute steels.

The Germans, too, developed a series of steels designed to give maximum hardenability with minimum amount of alloying elements. For highly stressed engine parts they frequently used steels with larger amounts of alloying elements than those used in this country for the same purpose. They used simple steels low in critical elements for low stressed parts. Vanadium was used in a number of their alloy steels.

The Japs selected excellent steels with deep hardenability, but too rich in alloying content. They used more nickel than necessary. Also they used deep hardening steels for thin parts where the deep hardenability was not required. They evidently planned on a short war and made no effort to conserve alloying elements.

Instead of one producer of aluminum as in 1940, 1947 finds the U. S. with three, ending the war with an ingot capacity in excess of a million tons yearly—over seven times the prewar capacity. Large quantities of secondary aluminum were also used during the war. Methods of refining were developed that produced high-quality ingot from a wide variety of scrap, including wrecked and obsolete aircraft. The first continuous rolling mills for aluminum sheet were put into use during this period.

Practically all countries had aluminum alloys of the duralumin type. The Germans carefully heat treated their duralumin to prevent intergranular corrosion. European bauxite was available to them, and they had much scrap which they were able to refine. The Japanese imported most of their bauxite.

Germany has much native magnesium ore so did a large amount of development work on that metal between the first and second world wars. It was often substituted for steel in order to gain in rigidity rather than to save weight. But the war caught Germany with insufficient production capacity, and as a result, steel and aluminum alloys had to be substituted for many aircraft parts originally designed for magnesium.

High-Temperature Alloys

Much development work is now being done on new aluminum and magnesium alloys for jet engines. The EM 62 alloy (6% Ce, 2% Mn, balance Mg) is being made more useful by new addition agents being developed by Battelle Memorial Institute in a program sponsored by Wright Field.

Germans used a low-carbon steel in some of their exhaust ducts instead of of the 18-8 stainless adopted as standard by United States and the British. Rapid deterioration, however, was experienced, necessitating frequent service replacements.

Finishing PROCESSES and PRODUCTS of ENTHONE RESEARCH

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FINISHING PROCESSES

ALUMON – a process for treating aluminum and its alloys to prepare it for electroplating with other metals.

ALUMOX – a process for chemically oxidizing aluminum to impart protection to corrosive atmospheres and prepare it for organic finishes.

EBONOL "C" – a process for chemically oxidizing and blackening copper and copper alloys. The finish is also a good base for painting.

EBONOL "S" – a chemical process for blackening iron and steel operated in the temperature range from 285-290°F.

EBONOL "Z" – a process for blackening zinc and zinc alloys.

FINISHING PRODUCTS
Aids for Better Pickling

ACID ADDITION AGENT – a surface active material which is added to hydrochloric and sulphuric acid pickles to prevent fuming, to inhibit attack upon the steel and promote better pickling.

INHIBITOR 7C – a powerful inhibitor for hydrocloric acid pickles either hot or cold to prevent attack upon base steel. The inhibiting action is approximately 99%.

COMPOUND NR-47 – an organic material which is added to hot water used for drying after pickling to prevent rusting or yellow staining of steel. No film is left upon the work to interfere with organic finishing.

Better Cleaning

ALUMINUM CLEANER E – an etching type cleaner for cleaning aluminum as well as etching.

ALUMINUM CLEANER NE – a powerful cleaner for cleaning aluminum without any attack or tarnish.

BRASS CLEANER – a powerful cleaner but has a mild action on brass, nickel-silver, lead-tin alloys, steel and other metals.

CLEANER 100 – an alkali cleaner of very high detergency for cleaning steel by soaking or electrolytic means.

EMULSION CLEANER – an emulsifiable solvent type cleaner for removing all solid dirt and oil as well as buffing compositions from all metals without attack or tarnish.

STRIPPERS

ENAMEL STRIPPERS: Various solvent and emulsion type strippers are available for rapidly removing enamels, lacquers and other organic coatings from all metals without attack.

ZINC STRIPPER – an alkaline process for rapidly stripping zinc plate from steel without any attack upon the steel.

RUST-PROOFING MATERIALS

NO. 15 OIL – a thin film oil for rust-proofing of steel. Protects 24 hours in salt spray and is a water shedding polar type oil.

SOLUBLE OIL – an emulsifiable rust-proofing oil used diluted with water to apply a rust-proofing film. Can be used with hot or cold water. Also an excellent cutting oil.

1568 WAX – an emulsion of clear hard-drying waxes to produce a hard rust-proofing finish on metals. Air dries fast and does not rub off.

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12-63. Quality Control Aids Supervisors. Part IV. David T. Armstrong. *American Machinist*, v. 91, March 27, 1947, p. 104-107.

Meaning of standard deviation; calculations; charts for variables.

12-64. Supersonic Flaw Detection Is Nondestructive. R. S. Davidson. *Industry and Power*, v. 52, April 1947, p. 79-81, 118.

Method similar to echo sounding from ships utilizes frequencies of approximately 750 kilocycles for locating flaws in nonmetals, as well as metals. Work at higher frequencies is believed to be applicable to investigation of internal structures of materials.

12-65. Supersonic Waves Locate Die-Block Flaws. R. W. Snowdon. *Steel*, v. 120, April 7, 1947, p. 95, 136-137.

Portable reflectoscope employs supersonic or ultrasonic waves which are transmitted into the material to be tested through quartz crystal. Contact is effected through light insulation oil applied to the surface of the piece.

12-66. Uma Classificacao e Descricao dos Acos-Niquel. (A Classification and Description of Nickel Steels.) Horacio Allyn Hunnicutt. *Boletim de Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 95-116.

A classification of nickel steels is proposed; a brief description of each type. Influence of nickel content on properties. (The article is based on English work, although not a direct translation.)

12-67. Thread Position Gages. *Machinery (London)*, v. 70, March 6, 1947, p. 225-231.

Design and production of a gage used for the Bren light machine gun.

12-68. Recording Magnetic Detector Locates Flaws in Ferrous Metals. C. H. Hastings. *Product Engineering*, v. 18, April 1947, p. 110-112.

Device, which operates on the principle of measuring the magnetic leakage caused by the presence of flaws in magnetized steel or other ferromagnetic materials, provides a dependable method of nonvisual flaw detection of cracks and other flaws on or near the interior surfaces of hollow parts such as cylinders and gun tubes.

12-69. The Use of Air Gages in Quality Control. Frank W. Blanchette. *Machine and Tool Blue Book*, v. 43, April 1947, p. 214-216, 218, 220, 222-226.

Application, measurement at the machine, and some sampling methods.

12-70. The Value of Highly Destructive Testing. Michael G. Corson. *Metal Progress*, v. 51, April 1947, p. 613-616.

Destructive tests on forged parts for variable-pitch propellers—parts rejected because of slight surface or sub-surface discontinuities—indicate that the body of the metal nearly always has considerably better tensile properties than specified, and the over-all strength of the part is far greater than the maximum requirements.

12-71. Gun Metal Castings, Radiographic Tests. William H. Baer. *American Foundryman*, v. 11, April 1947, p. 111-116.

Identifies various typical defects in gun metal by means of radiographs. More than 100 gun metal plates 8x8x1 in. of nominal composition 88% copper, 8% tin, and 4% zinc, were cast under carefully controlled conditions so as to produce the defects. Complete records of melting and molding practice were kept to facilitate the reproduction of the defects when required. Defects included distributed shrinkage, hot tears, sand and slag inclusions, and gas porosity. Investigation was confined to the correlation of defects with foundry practice.

12-72. Magnetic Particle Inspection, Castings Industry Applications. W. E. Thomas. *American Foundryman*, v. 11, April 1947, p. 104-110.

Foundry uses for magnetic particle inspection: as an aid in developing molding and pouring technique; as an aid in developing cleaning and foundry processing practices; as an aid in production control; as an aid in the repair of defects; and as an aid in the final inspection for defects.

12-73. The Practical Aspect of Modern Quality Control Methods. Clifford W. Kennedy. *Iron Age*, v. 159, April 10, 1947, p. 66-69.

A practical down-to-earth appraisal of quality control methods, what quality control is, how it affects costs and how it can be put to work for management without the necessity of elaborate preparation.

For additional annotations indexed in other sections, see:
3-91-95; 4-39; 24-93; 27-78.

13 PYROMETRY Temperature Control

13-8. Temperature Instruments of the Future. Paul G. Weiller. *Instruments*, v. 20, March 1947, p. 231-233.

The author speculates on what the "ideal" instrument of the future will be like, and describes the various features which he believes should be perfected and incorporated into such an instrument.

13-9. High Nickel-Chromium Alloys Increase Thermocouple Life. E. A. Murphy. *Materials & Methods*, v. 25, March 1947, p. 133.

A number of nickel-chromium-iron alloys were investigated for use as thermocouple protection tubes. For the majority of industrial applications, Inconel (80% Ni, 14% Cr, 6% Fe) was most satisfactory.

13-10. Measurement of Temperature in the Openhearth. John R. Green. *Blast Furnace and Steel Plant*, v. 35, March 1947, p. 344-347.

Involves measurements in, over, around and through hearth. Platinum thermocouple method, air purged sighting tube method, roof temperature measurement. (To be continued.)

13-11. A Multiple Point Repeating Switch for Use With a Recording Potentiometer. Aaron M. Altschul. *Review of Scientific Instruments*, v. 18, March 1947, p. 195-197.

Switch for obtaining a temperature record from each of 22 locations once every hour or two. Two single-point recorders.

13-12. The Selection and Installation of Thermocouple Extension Lead Wires. C. C. Roberts and C. A. Vogelsang. *Industrial Heating*, v. 14, March 1947, p. 370-372, 374, 376, 378, 380, 382.

Layout of a typical modern installation of extension lead wire for a heat treating department. Use of improperly installed lead wires impairs both the accuracy of the temperature indication and control of the process variable. Careless wiring, poorly soldered or unsoldered splices, carelessly taped splices, or mechanical abrasion of the lead wire insulation, can result in either complete or partial failure of the pyrometer system.

13-13. A Symposium on the Contamination of Platinum Thermocouples. *Journal of the Iron and Steel Institute*, v. 155, Feb. 1947, p. 213-234.

Includes the following papers by various authors submitted by the Liquid Steel Temperature Sub-Committee of the Ingot Committee of the Iron and Steel Institute: An Investigation of Embrittlement of Platinum-Rhodium Wire in the Heads of Liquid-Steel Pyrometers; Fracture of Platinum and Platinum-13% Rhodium Wires Used in the Immersion Thermocouple; An X-Ray Investigation of the Embrittlement of Platinum and Platinum-Rhodium Wires: Contamination and Failure of Rare Metal Thermocouples; Embrittlement of Platinum and Platinum-Rhodium Thermocouples; and An Examination of the Microstructure of Contaminated and Embrittled Platinum and Platinum-Rhodium Wires.

13-14. Instrument for Measuring Openhearth Flame Radiation. E. M. Yard. *Blast Furnace and Steel Plant*, v. 35, April 1947, p. 46, 48, 72, 85.

The effect of radiation on heat transfer in the openhearth. A simple, portable, and rugged instrument (designed and built for use by one man) is believed to be more practical for the average plant than the usual complicated and expensive set-up. An unusually sensitive vacuum-tube voltmeter was designed to measure the e.m.f. generated by the pyrometer. Sample readings and how they are used as an aid in the control of furnace settings.

13-15. Measurement of Temperature in the Openhearth. Part II. John R. Green. *Blast Furnace and Steel Plant*, v. 35, April 1947, p. 443-447.

The measurement of "flame character" or "radiating power". This is important because a high percentage of heat transfer between furnace and bath is by radiation. Measurement of radiation at various points in the furnace, using either permanent or portable instruments. Major emphasis is placed on measurement of the temperature of the top course of the checkers by means of a Brown radiamatic instrument connected to a recorder, and its connection to an automatic system for regenerator reversal control.

13-16. Immersion Thermocouple, Simplified Protection Tube. W. A. Spindler. *American Foundryman*, v. 11, April 1947, p. 125-126.

Thermocouple devised to facilitate and improve the accuracy of temperature measurements when taking the temperature of the molten metal in the electric rocking furnace; and also while following the drop in temperature of the metal in the ladle, when it is desired to pour at a certain temperature.

13-17. Nickel Alloys Form Multihelix Thermometer Element. *Product Engineering*, v. 18, April 1947, p. 98.

Invar and another nickel alloy, when welded together and rolled to proper thickness, form an excellent bimetallic thermometer. Invar is a nickel alloy with practically no expansion at ordinary temperatures, and the other alloy has a high and constant rate of expansion, and is not appreciably affected either by humidity or by constant flexing.

For additional annotations indexed in other sections, see:
16-48.

ELECTRONIC TEMPERATURE CONTROLS
Pyrometer-Potentiometer and Resistance Thermometer Controllers. Combustion Safeguards.
Wheelco Instruments Co. Chicago, Ill.

14 FOUNDRY PRACTICE

14-90. Theory and Practice of the Aluminum Sand Foundry. F. Raybould. *Foundry Trade Journal*, v. 81, March 6, 1947, p. 171-176.

A few simple examples of the wide range of work involved in a light alloy foundry, illustrating direct application of technical theory to practical foundry operations. Covers molding

(Turn to page 32)

Engineers Urged to Assume Business & Gov't Responsibility

Reported by John M. Kiefer

Laboratory Supervisor
American Steel & Wire Co.

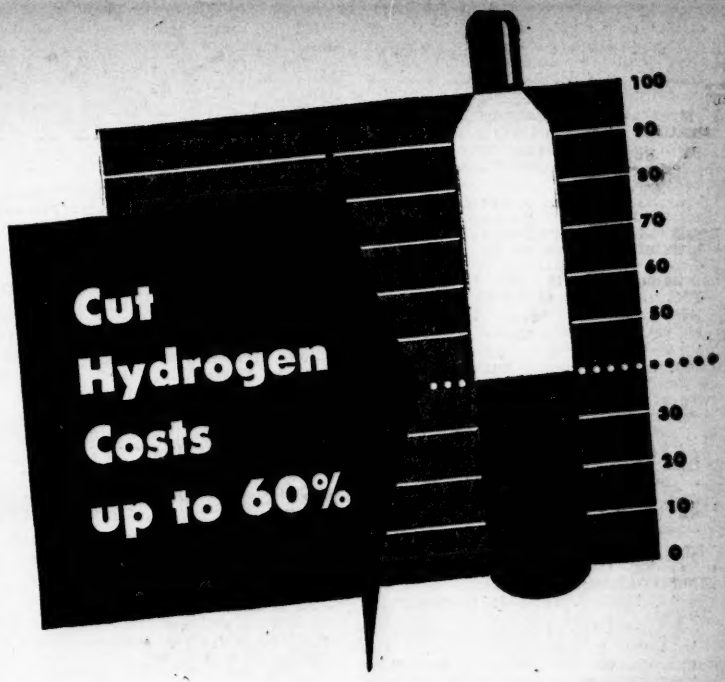
The world in which we live is for many persons not a real one but one of make-believe, Frederick C. Crawford, president of Thompson Products, Inc., told the Cleveland Chapter on March 3, speaking on "Business and Metallurgy". For that reason he urged all engineers to broaden their viewpoints and to assume responsibility in government and business. Engineering training should give one a realistic and factual outlook which is sorrily absent in government today.

Mr. Crawford drew an analogy between life in America in 1947 and in 1633. The early settlers came to America to escape the complexities, intolerance, unemployment and poverty of the England of those days, which were fully the equal of what we have had in America in recent years. In the new world they faced the same problems as we face today—unemployment, national defense, relief, personal freedom. Yet they faced them realistically and set up rules and regulations which were based on the rights as well as the obligations of the individual.

In Mr. Crawford's estimation the present United States Government—and particularly the preceding administration—formed huge monopolies of labor organizations, increased taxation to the point of confiscation, took from the doers and gave to the loafers, and set up a host of administrators to enforce its wishes. It is his belief that today we have returned to the same political and economic condition which the Pilgrims escaped from in a corrupt and bureaucratic England.

The Constitution was supposed to preserve the rights of the individual, Mr. Crawford continued. Yet today it has been set aside by an incompetent Supreme Court and detoured by fantastically broad interpretations of the interstate commerce clause. The latter dodge has enabled the Federal Government to interfere in practically any controversy that it wishes, no matter how local or trivial.

The principal recourse open to the individual and the businessman, he said, is to sell other individuals and especially stockholders on the importance of getting rid of this enormous bureaucracy through the ballot box. Business has done an excellently successful job of selling its products yet it has done practically nothing to sell the people on the idea of eliminating the regulations which are slowly choking business and the profit system. It was his opinion that the profit a product brings is a measure of its usefulness. Engineers should seize the initiative and assume responsibilities of government and public service.



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sands; core sands; the mold; use of chills; and metal conditions. (Paper read before the London branch of the Institute of British Foundrymen. To be continued.)

14-91. Magnesium Molding Sands. *Light Metals*, v. 10, March 1947, p. 120-123.

Magnesium casting technique. A new method of preparing synthetic molding sands.

14-92. Introduction a l'Etude des Défauts de Fonderie. (Introduction to the Study of Foundry Defects.) Francois Boussard. *Fonderie*, no. 12, 1946, p. 431-434.

Compilation of the International Dictionary of Foundry Defects, where these defects are classified by their aspect and their cause. Sixty-seven defects are listed.

14-93. L'Etat Actuel de la Centrifugation en Fonderie. (The Present State of Centrifugal Casting in the Foundry.) Jacques Boucher. *Fonderie*, no. 12, 1946, p. 435-437; discussion, p. 437.

The three general methods of centrifugal casting: pure centrifugation on a horizontal, vertical, or inclined axis; semicentrifugation on a vertical axis; and casting under centrifugal pressure on a vertical axis.

14-94. La Fabrication des Lingotières d'Aciéries. (Manufacture of Steel Ingot Molds.) Alphonse Charmeau. *Fonderie*, no. 12, 1946, p. 446-450; discussion, p. 450-452.

Examination of the qualities required in ingot molds by steelmakers and analysis of the necessary factors in their production; manufacture of ingot molds at a French foundry; research for improvement of service life.

14-95. Quelques Remarques Pratiques sur les Gaz dans l'Acier et la Fonte. (Some Practical Remarks on Gases in Steel and Cast Iron.) Eugene Eyt. *Fonderie*, no. 12, 1946, p. 438-439.

The influencing factors in foundry difficulties attributed to dissolved gases, viscosity, heat conductivity, and surface tension.

14-96. Internal Risers for Steel Castings. Turney Shute. *Canadian Metals & Metallurgical Industries*, v. 10, March 1947, p. 24, 41, 44, 49.

Where internal risers can be used and their advantages.

14-97. Producing Steel Castings Without Venting Molds. J. Richard Adams. *American Foundryman*, v. 11, March 1947, p. 26-29.

The pros and cons of venting. Author believes that venting is unnecessary and backs up his opinion by citing a number of examples. Savings of $6.00 to $10.00 per ton have resulted from elimination of venting in jolt-squeeze and slip-flask work.

14-98. Magnesium Alloys. Small Calcium Additions. Marvin E. Gantz. *American Foundryman*, v. 11, March 1947, p. 33-38.

Technique adopted by the American Magnesium Corp. for making calcium additions, and some of the advantages and disadvantages of using calcium.

14-99. Foundry Dust Control Systems. *American Foundryman*, v. 11, March 1947, p. 42-47.

Hoods and Piping, by E. A. Carsey and Maintenance, by Kenneth M. Smith.

14-100. Automotive Foundries Around Detroit. *Foundry*, v. 75, April 1947, p. 94-105.

Pictures show operations at a number of foundries.

14-101. Sand Control. George A. Zabel. *Foundry*, v. 75, April 1947, p. 110-112, 150, 152.

Methods used at Universal Foundry Co., Oshkosh, Wis.

14-102. Pressure Casting Matchplates. Edwin Bremer. *Foundry*, v. 75, April 1947, p. 124-126, 284-286.

Techniques used at Ebaloy, Inc., Rockford, Ill., in the casting of nonferrous alloys using compositions of gypsum cement or plaster of paris.

14-103. Theory and Practice of the Aluminum Sand Foundry. Part II. E. Raybould. *Foundry Trade Journal*, v. 81, March 13, 1947, p. 197-202. Discussion: March 20, 1947, p. 223-225.

Design influence; choice of alloy; influence of alloy composition; gas porosity. (Paper read before the London branch of the Institute of British Foundrymen.)

14-104. Utilization of High Sulphur Coke in Foundry Practice. *Foundry Trade Journal*, v. 81, March 20, 1947, p. 217-219.

The steps which may be taken to overcome the deleterious effect of a high sulphur content on the metal. Methods of minimizing the pick-up of sulphur during cupola melting, and desulphurization of molten metal.

14-105. Defective Castings. "Shedrick". *Iron and Steel*, v. 20, March 1947, p. 88, 107.

Their cause and cure.

14-106. Foundry Waste. A. J. Edgar. *Iron and Steel*, v. 20, March 1947, p. 97-100.

Need of accuracy in weighing; an efficient heat transfer process; proper coke bed height; control of cupola operations; elimination of loss of cores due to mistakes in coremaking and core assembly; regulation of casting temperature to prevent waste.

14-107. Copper Tuyères. *Iron and Steel*, v. 20, March 1947, p. 105-107.

Method adopted in Germany employing the centrifugal casting process, using vertical centrifugal machines and electrolytic copper as the material. A method of rolling tuyères from cast blanks.

14-108. Foundry Sand Produced Near Eugene, Oregon. W. D. Lowry. *Mining Technology*, v. 11, March 1947, T. P. 2058, 10 p.

The properties and geology of the deposits, the washing plant, and the results of large-scale foundry tests.

14-109. Problems Ahead as Seen by Division and Committee Chairmen. *American Foundryman*, v. 11, April 1947, p. 76-81, 166.

Twelve brief articles outline some of the problems awaiting solution in foundry work.

14-110. Foundry Mechanization, Design-Operation. C. O. Bartlett. *American Foundryman*, v. 11, April 1947, p. 82-90.

The layouts of the equipment installed in gray iron foundries for mechanization.

14-111. Foundry Sand Laboratory. O. Jay Myers. *American Foundryman*, v. 11, April 1947, p. 117-122.

The organization of such a laboratory.

14-112. Aluminum Casting Alloy; Fluxes—Degasifiers—Grain Refiners. James D. Kline. *American Foundryman*, v. 11, April 1947, p. 123-124.

Metallic fluxes as deoxidizers; fluxing alloys as grain refiners; salt fluxes as melting covers.

14-113. Patterns for Production. John E. Gill. *American Foundryman*, v. 11, April 1947, p. 127-128.

The new methods being applied in foundry pattern design and making.

14-114. Molding Sand Binders. L. Jenicek. *American Foundryman*, v. 11, April 1947, p. 132-140.

Czechoslovakian author describes his own experimental results and experiences and quotes those of other investigators, the purpose being to inform the American foundryman concerning the trends of European investigations during the wartime period. 19 ref.

14-115. Requirements for Setting Up a Precision Investment Casting Plant. Alexander Saunders. *Iron Age*, v. 159, April 10, 1947, p. 70-74.

The process in general with some of the newer equipment developed specifically for the process; the labor and capital requirements for setting up a casting plant.

14-116. Foundry Ventilation. Jim Black and Lester T. Avery. *Heating, Piping & Air Conditioning*, v. 19, April 1947, p. 78-81.

The exhaust systems for one molding line in a mechanized gray iron foundry having seven molding lines, two open floor areas, four cupolas, and an electric furnace.

14-117. Vacuum Melting and Casting. Allen G. Gray. *Steel*, v. 120, April 14, 1947, p. 86-88, 132, 136, 139, 140, 142, 144.

General principles, status, and future possibilities of technique as practiced here and abroad.

For additional annotations indexed in other sections, see:
2-50-63; 4-46; **11**-44; **12**-71-72; **22**-186; **23**-100-101-102; **24**-97-99-101-102; **25**-51-57; **27**-77.

15 SALVAGE AND SECONDARY METALS

15-10. Making Useful Things From Scrap. G. A. Goener. *Railway Age*, v. 122, March 29, 1947, p. 657-659.

Methods used by the Chicago, Burlington & Quincy Railroad for reclamation of scrap materials.

15-11. Mexican Cement Plant Designed to Use Waste Slag From Nearby Steel Works. *Pit and Quarry*, v. 39, March 1947, p. 87-88.

A description of plant procedures.

15-12. Separating Metals From Dross. *Edgar Allan News*, v. 25, March 1947, p. 777-778.

A batch of material comprising dross and metallics is fed into machine. A charge of steel balls in the inner chamber separates metal from dross by attrition. The mill consists of a hard steel cylinder having long slotted apertures which allow dross to leave this chamber after being separated from the metal by the action of the steel balls. It is suitable for metals such as silver, copper, brass, aluminum.

15-13. Handling Salvage at a Profit. *Flow*, v. 2, April 1947, p. 26-27.

Plant saves $5.00 to $9.00 per ton through an efficiently-engineered metal scrap-handling system.

15-14. Steel Firms Conserve Scrap by Using Heavier Charges of Iron Ore. *Iron Age*, v. 159, April 17, 1947, p. 104-105.

Table gives shipments of steel products, for 1946, and production of open-hearth, bessemer, and electric steel ingots and steel castings for 1946 and 1947.

For additional annotations indexed in other sections, see:
23-111; **27**-68.

16 FURNACES AND FUELS

16-37. New Developments in Heat Processing Equipment. F. G. Daveler. *Gas Age*, v. 99, March 20, 1947, p. 21-24, 60, 62.

Controlled atmosphere producing equipment, accelerated drying ovens for paints, high-speed aluminum annealing, and glass-dropping kilns.

16-38. Electronic Heating Units Show Economy, Speed. *Electronic Industries & Electronic Instrumentation*, v. 1, March 1947, p. 2-3.

The factors involved in deciding on

(Turn to page 34)

Microhardness Testing Aids Solution of Varied Metallurgical Research Problems

Reported by Daniel J. Clini
Heatbath Corp.

Microhardness testing, according to usage in this country, refers to the testing of thin materials, small diameter wire, small specimens, such as watch parts, determination of hardness gradients in superficially hardened surfaces, exploring hardness variations over small areas and determination of the hardness of different metal constituents. With this definition V. E. Lysaght, engineer and sales manager of the Wilson Mechanical Instrument Co., Inc., described application of microhardness testing to metallurgical problems before members of the Springfield Chapter on Feb. 17.

The process is by no means confined to measuring the hardness only of the components of a microstructure, he said. In fact, this class of work represents probably a minimum of the work done by microhardness testing.

Microhardness testers are of two types—scratch and indentation. The scratch method was originally conceived to determine the hardness of minerals. Hardness is a function of the width of a microcut made by a diamond point as the material to be tested is moved beneath the point under a definite pressure. After the cut is made, its width is measured under a microscope and the hardness determined from the formula.

In 1939 the National Bureau of Standards announced the development of the Knoop indenter, a sensitive diamond tool, which gives indentations of accurately measurable length in the most resistant steels with loads less than 1000 g. The Tukon tester is capable of applying light loads, even down to 25 g., using the Knoop indenter. The tester is fully automatic under electronic control in a synchronous cycle. The indentation is made by elevating the specimen against the indenter until the hardness of the specimen resists further indentation. As this condition is reached, an electronically controlled circuit prevents further elevation of the specimen and the load is applied, controlled by means of a timing motor, for about 20 sec. At the end of this time interval, the indenter is automatically removed from the specimen and the elevating screw lowered. To eliminate errors due to kinetic load of contact between indenter and specimen, a loading solenoid is provided. Dead weight loads of 25 to 3600 g. are available.

For making indentations in selected small areas, an accurately designed mechanical stage is necessary. An area of a few thousandths of a square millimeter can be accurately located under the microscope, the specimen then moved under the indenter, the indentation made on the selected location, and the specimen returned under the microscope for the purpose of reading the dimensions of the impression. In actual practice, the Knoop number is obtained from a table.

Watch parts and drill rod, mounted in thermosetting plastic and polished like metallographic specimens, can be tested with this machine. It is also used for quantitative control of the hardness of shallow electroplated surfaces or other hard, thin surface coatings, and for probing the limits of decarburization. Morrison and Gill have evaluated the surface hardness of nitrided cases on high speed steel where the microscopic case depth is only 0.0005 in.

Knoop hardness gradients through carburized cases give invaluable information to the metallurgist. Common practice is to specify case depths of 0.015 to 0.020 in. and to grind the surface after heat treatment. If 0.010 or 0.012 in. is removed there is a possibility of getting below the optimum hardness values. Even high-magnification metallographic examination may fail to show this, for it is difficult to distinguish between tempered martensite and softer transformation constituents where there is a difference of only 3 or 4 Rockwell C numbers.

On induction hardened parts it is possible, with the Knoop indenter, to survey the depth of hardening and regulate the heating cycle accordingly. Here again the probing of the transition zone with the Knoop indenter has, in some instances, served better than the high-powered metallographical microscope.

Bimetals in thin strip form made up of two layers, each only 0.0015 or 0.002 in. thick, are routine tested for the hardness of each component.

Short Course on Quality Control

An advanced eight-day course in "Quality Control by Statistical Methods" is to be presented June 27 through July 5 at Purdue University, Lafayette, Ind. It is intended for those who already have some acquaintance with statistical quality control and will be under the leadership of I. W. Burr of Purdue University. Requests for further information should be addressed to Mr. Burr.

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electronic heating for different applications.

16-39. Induction Melting Furnaces. Frank T. Chestnut. *American Foundryman*, v. 11, March 1947, p. 22-25.

Use of an electric induction furnace is justified where the metal to be melted is of a critical analysis, where its quality must be kept high or where flexibility and working conditions are important considerations. The furnace to be used should be determined by the economics of a particular set of conditions, including the stand-by charge for power, the kind and volume of metal to be melted, the length of the working day, and the life of the refractories involved in the operation.

16-40. New Homestead Openhearths Feature Highly Automatic Control. Robert Urquhart. *Iron Age*, v. 159, April 3, 1947, p. 46-52.

Outstanding automatic features; furnace construction; plant layout.

16-41. Heat Treating Aircraft Engine Parts at Pratt & Whitney Kansas City Plant. Part II. *Industrial Heating*, v. 14, March 1947, p. 386-388, 390, 392.

Box-type hardening furnaces especially designed for hardening propeller shafts; a continuous draw furnace for the hardened shafts; a conveyer-type brazing furnace.

16-42. Openhearth Steel Furnaces. W. F. Cartwright. *Institute of Petroleum Review* (Supplement), Jan. 1947, p. 31-32.

Advantages of fuel oil for openhearth furnaces.

16-43. Ferrous Metals. A. Stirling. *Institute of Petroleum Review* (Supplement), Jan. 1947, p. 32-33.

Advantages of fuel-oil firing for batch and continuous-type reheating furnaces.

16-44. Nonferrous Metals. J. Sykes. *Institute of Petroleum Review* (Supplement), Jan. 1947, p. 33-34.

Advantages of fuel-oil firing in smelting, refining, melting, casting, and annealing.

16-45. Fornos de Inducao. (Induction Furnaces.) Olavo Egydio Setubal. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 143-155; discussion, p. 155-156.

Different types of induction furnaces with reference to method of operation, capacity, and type of current used. Losses, frequencies for different types of charges, and refractories used. 15 ref.

16-46. Fornos de Inducao e Suas Aplicacoes na Industria Metalurgica. (Induction Furnaces and Their Applications in the Metal Industry.) P. G. Paula Leite. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 157-174.

Operation and applications. 18 ref.

16-47. O Forno "Elkem" de Sola Rotativa Para Processos Eletrotermicos. (The "Elkem" Furnace With Rotating Base for Electrothermic Processes.) T. Ellefsen. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 175-184.

The "Elkem" type of electric furnace, for the production of ferroalloys and calcium carbonate, aids in avoiding the sintering of the charge around the electrodes. The modification described is claimed to assure perfect operation to increase the capacity and to decrease the consumption of raw materials.

16-48. Furnaces for Steelmaking. J. H. Chesters and M. W. Thring. *Journal of the Institute of Fuel*, v. 20, Feb. 1947, p. 77-90.

The development of regenerative furnaces; the thermodynamics of steelmaking; heat transfer in the Siemens furnace, measurement and control of furnace input, and the inner working of the furnace. Under the latter are included: measurement of total heat flow; subdivision of flame radiation into the effects of flame emissivity and flame temperature with the narrow-angle radiometer; the effect of water-cooling in heat flow inside the furnace; and effect of different port designs on flame shapes. (Based largely on the work reported more fully in Iron and Steel Institute Special Report No. 37.)

16-49. Liquid Fuel. C. Croxford. *Iron and Steel*, v. 20, March 1947, p. 83-87.

The advantages of liquid fuel firing compared with gas, and some of the snags likely to be met.

16-50. Symposium on Soaking-Pit Operation. Part I. *Industrial Heating*, v. 14, April 1947, p. 602-604, 686.

Review of symposium on soaking-pit operation featuring discussion of equipment and methods in existing plants.

16-51. Ferrous and Nonferrous Metals Treated in Commercial Steel Treating Co. Plant. Part I. *Industrial Heating*, v. 14, April 1947, p. 652, 654, 656, 658.

Continuous pusher-type heat treating furnace; electric salt bath furnace; reciprocating-hearth continuous hardening furnace; rotary-retort gas carburizing furnace. (To be continued.)

16-52. The What and How of Radio-Frequency Heating. B. E. Rector. *Tool Engineer*, v. 18, April 1947, p. 18-21.

Basic principles of induction and dielectric heating.

16-53. Oxides Renew Electrodes in Electric Furnace. *Tool Engineer*, v. 18, April 1947, p. 32.

How oxides which form in the salt bath from three sources (contact with atmosphere at the surface, from the work itself, and from the electrodes) are employed to self-perpetuate the electrodes. Oxides circulating through bath contact graphite rod and are reduced to metallic scale. As carbon content increases, the melting point of scale is decreased. Scale forms in droplets and falls on, and becomes integral part of, electrode when carbon content of droplet is reduced.

16-54. Economy in Electric Arc Furnace Operation. T. Starling Winters. *Steel*, v. 120, April 14, 1947, p. 108-110, 113.

How new automatic regulator controls kw. maximum demand of electric-arc furnaces by supervising movement of furnace electrodes. Employment of a new heat-proof circuit insures cooperation of melters.

For additional annotations indexed in other sections, see:
2-52-61-70-75; 7-121; 14-104-117; 17-28-35; 18-77-78-82.

17 REFRACTORIES Furnace Materials

17-24. Elastic Behavior and Creep of Refractory Brick Under Tensile and Compressive Loads. Lewis E. Mong. *Journal of the American Ceramic Society*, v. 30, March 1, 1947, p. 69-78.

Specimens from nine brands of firebrick, including two high-alumina, four fireclay, two siliceous fireclay, and one silica were subjected to tensile and compressive creep tests at 11 temperatures from 25 to 950° C. inclusive, for 240 days. Creep results under compressive stress could not be correlated with results under tensile stress. Moduli of elasticity at room temperature were determined before and after the various heat treatments. 12 ref.

17-25. Structural Design of Refractory and Heat Resistant Concrete. Part II. *Industrial Heating*, v. 14, March 1947, p. 464, 466, 468, 470, 472, 511.

Basic design factors governing the use of refractory concrete made with calcium-aluminate cement, including unit strengths, volume changes, and methods of reinforcing; and the use of the material in ducts, flues, stacks, combustion-chambers, coke-oven batteries, heat treating, and annealing furnaces, as a structural and a lining material. (To be continued.)

17-26. Refractories Industry of Italy. Luigi Ponpei. *American Ceramic Society Bulletin*, v. 26, March 15, 1947, p. 88-93.

Information of a general and statistical character on available raw materials and types of refractories produced from them. Plants, control and research laboratories, and Italian technical and scientific organization. Unusually good thermal expansion and load-test equipment.

17-27. Ceramic Industry of Japan. Everett A. Thomas. *American Ceramic Society Bulletin*, v. 26, March 15, 1947, p. 94-99.

The Japanese ceramic industries are analyzed from the standpoint of production history and consumption up to 1945, inclusive. Chinaware and porcelain, porcelain enamel, structural clay products, refractories (including clay, basic, and silica), graphite crucibles, abrasive grinding wheels, and glass (including flat glass, glassware, optical glass, and fiber glass).

17-28. Cupola Refractories. Ray A. Witschey. *Foundry*, v. 75, April 1947, p. 120-123, 242, 246, 248.

Design of the refractory linings for cupolas. (Presented at Chicago Regional Foundry Conference, Nov. 21, 1946. To be concluded.)

17-29. Refratarios de Silica E Seu Emprego nos Fornos Siemens-Martin. (Silica Refractories and Their Use in Siemens-Martin Furnaces.) Felippe J. V. de A. Franceschini. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 207-224; discussion, p. 224-226.

A series of high-quality refractories was investigated for classification according to their properties, namely, thickness required, durability, and joint expansion. 12 ref.

17-30. Elastic Behavior and Creep of Refractory Bricks Under Tensile and Compressive Loads. Lewis E. Mong. *Journal of Research of the National Bureau of Standards*, v. 38, Feb. 1947, p. 229-240.

Nine brands of firebrick, including two high alumina, four fireclay, two siliceous, and one silica, were subjected to creep tests, at 11 temperatures from 25 to 950° C., inclusive. Creep results with compressive stresses could not be correlated with results with tensile stresses. Moduli of elasticity at room temperature were determined before and after the various heat treatments. Changes were large for silica brick and small for fireclay brick. 13 ref.

17-31. First Report of the Converter Refractories Subcommittee. *Journal of the Iron and Steel Institute*, v. 155, Feb. 1947, p. 235-269.

Current practice regarding the internal shape of converters and the materials used for lining and patching. Properties of materials were extensively investigated in the laboratory and an effort made to correlate them with practical results. The drying and preheating of converter linings including the working temperature of the lining during these periods; subsequent blowing; results of examination of the linings before and after use.

17-32. How Germans Make High Temperature Refractories and Ceramics. *Brick & Clay Record*, v. 110, April 1947, p. 64, 66, 68.

Condensation of B.I.O.S. report outlines results of visits to 12 German plants and laboratories.

17-33. Examination of Polished Specimens of Refractories by Reflected Light. J. Raymond Hensler and Samuel Zerfoss. *Journal of the American Ceramic Society*, v. 30, April 1, 1947, p. 105-108.

The preparation of specimens and the polishing, etching, and identification of phases when the technique is

(Turn to page 36)

Reasons for Testing Metals Enumerated

Reported by John W. Sweet

Chief Metallurgist, Boeing Aircraft Co.

Reasons for making physical tests are to accumulate data for the designer, to develop specifications for the purchasing agent, to gather fabrication information for the manufacturing unit, and to establish standards of quality for inspectors. These reasons were elaborated upon by Blake D. Mills, Jr., in an address before the Puget Sound Chapter on "Engineering Significance of Metal Testing". Professor Mills is on the faculty of University of Washington.

Data supplied to the designer, Mr. Mills pointed out, are not always properly related to service life. Specific examples were cited to stress the importance of tests to simulate the actual loading of a structure, and the information secured from the tension test was explained.

Mr. Mills then discussed the significance of notch impact testing, including the effect of low temperature on the test, results of impact tests on various structures developed in steel by slack quenching, and the effect of temper brittleness. Relation of the results obtained from the impact test to service life is an open subject for discussion, he said.

The talk was closed by a review of methods of quality control, such as hardness testing, magnetic inspection, fluorescent penetrant methods, X-rays, and supersonic testing.

Complicated Dies Are Steel Treater's Headache

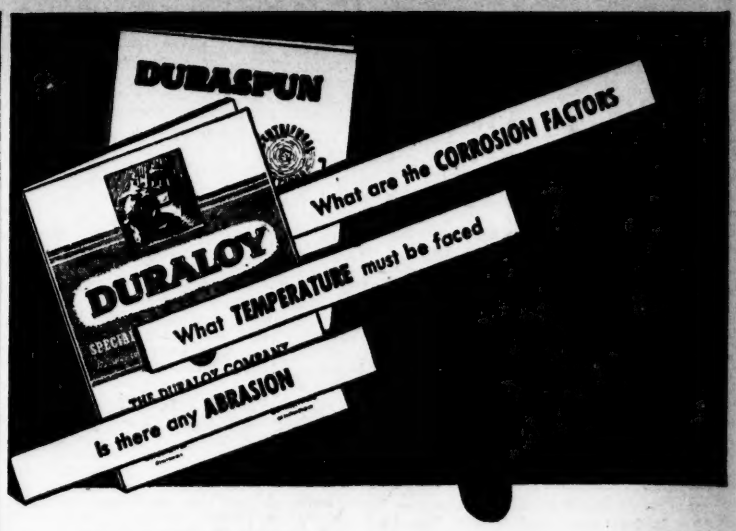
Reported by Ray E. Cross

Chief Metallurgist, Michigan Light Alloys

Problems encountered by the commercial heat treater, such as growth, shrinkage, warpage and cracks, were detailed by Edward J. Pavesic of Lindberg Steel Treating Co. before the West Michigan Chapter's February meeting. Mr. Pavesic's talk on "Heat Treatment of Steels" supplemented the lecture course sponsored by the chapter and recently completed by L. J. Haga of State Heat Treat.

Mr. Pavesic showed several slides of the especially complicated dies that are a steel heat treater's headache. He used curves to explain reasons for cracking and showed how changes in heat treating procedure provide practical solutions to the problem.

Martempering or interrupted quenching has aided materially in the solution of many problems; while not a cure-all, it is finding wider use as heat treaters work with it. Advantages of quenching in air, oil, water and salt were pointed out, and quenching curves explained. Martempering reduces distortion and cracking and enables the heat treater to meet hardness requirements.



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applied to basic and silica refractories. Method shows the relationship of high-iron slag to tridymite and cristobalite in the silica brick and aids in explanation of the bursting of chrome magnesite brick by iron oxide.

17-34. Shrinkage Rates in Firing Fireclay Refractories. Donald K. Stevens and Raymond E. Birch. *Journal of the American Ceramic Society*, v. 30, April 1, 1947, p. 109-113.

Direct optical measurements of length changes of five commercial fireclay refractories were made during 72-hr. firing on a uniform heating schedule of 35° F. per hr. Data obtained from room temperature to 2700° F. revealed three periods of high shrinkage rate.

17-35. Progress Report on Carbon Linings for Blast Furnaces. V. J. Nolan. *Blast Furnace and Steel Plant*, v. 35, April 1947, p. 454-460.

Thirteen American installations now in operation and twelve more in various stages of construction or planning. Conclusions reached from a study of the linings which have been installed. German use of carbon linings.

17-36. Refractories and Their Use in Steel Plants. Part II. *Industrial Heating*, v. 14, April 1947, p. 640, 642, 644.

Abuses to which refractories may be subjected, and refractory materials other than brick.

For additional annotations indexed in other sections, see:
16-45; 27-84-86.

18 HEAT TREATMENT

18-61. High-Hydrogen Atmosphere Intensifies Quench Cracking Tendency. C. A. Liedholm. *Metal Progress*, v. 51, March 1947, p. 414-419.

Laboratory tests and confirming evidence from production heat treating experience which have led to the conclusion that hydrogen content of a reducing furnace atmosphere is a tremendously potent factor in quench cracking—the more so, the higher the carbon content of the steel or carbon pressure of the atmospheres, or the greater the severity of the quench. Experiments have resulted in the development of a test method which has yielded results that have clarified formerly obscure relationships among quench cracking, carbon content, atmosphere, and quench delay. Background information concerning the product of manufacture, the quenching method, and the materials involved.

18-62. Reducing Distortion in Case-hardened Nickel-Chromium Gears. C. A. E. Wilkins. *Metal Progress*, v. 51, March 1947, p. 441.

A successful heat treating and cooling schedule involves cooling in air from 1560 to 1400° F. and oil quench.

18-63. Heat Treating Schedules. J. Edwin Burkhardt. *Metal Progress*, v. 51, March 1947, p. 442.

Revised schedules for four aluminum alloys permit substantial time saving.

18-64. On-the-Job Annealing. *Metal Progress*, v. 51, March 1947, p. 443.

Flame of gas torch directed at work being spun is controlled by foot pedal.

18-65. Attempts to Accelerate the Nitriding of Steel. *Engineer*, v. 183, March 7, 1947, p. 194.

Critically reviews work of Kunze and and of Bennek and Rüdiger reported in *Archiv für das Eisenhüttenwesen* in 1944; and of Jones who developed two-stage nitriding in the U. S.

18-66. Continuous Hardening, Quenching, Washing, Drawing Forgings. *Steel*, v. 120, March 24, 1947, p. 84, 86.

How drop forgings are continuously heat processed from hardening to drawing in an automatic installation based on idea of synchronizing movement through all operations in a predetermined, fully mechanical cycle without intermediate manual handling.

18-67. Mass Production Heat Treating. *Steel*, v. 120, March 24, 1947, p. 88, 90.

Flexibility possible in modern equipment is illustrated by special gas carburizing and carbo-nitriding installations.

18-68. Salt Baths for Metals. Edwin Laird Cady. *Materials & Methods*, v. 25, March 1947, p. 99-114.

Salts used for casehardening, through hardening, quenching, and descaling ferrous metals; annealing nonferrous metals; soldering and brazing; and heating metals for forming. Information on various current uses for salt baths.

18-69. Fixture for Handling Work in Heat Treat Furnace. Stanley Lapinski. *Materials & Methods*, v. 25, March 1947, p. 133.

Fixture consists of yoke provided with a special handle that controls the revolution of the swiveling lift-rods. The lower or grid end of these lift-rods is bent to a 90° angle or hook, so that they will fit under the grid. Grid has clearance pads on the underside which provide clearance for the movement of the hook part on the lift-rods. Complete fixture carrying the work can be lowered into the furnace work chamber by means of an overhead crane or hoist, and the lifting yoke and swiveling lift-rods disengaged, and removed. Thus, only the grid and actual work load remain in the furnace.

18-70. Controlled Furnace Atmospheres. A. G. Hotchkiss. *Steel Processing*, v. 33, March 1947, p. 151-156, 179.

Atmospheres preventing oxidation and atmospheres preventing carburizing and decarburizing. (To be continued.)

18-71. Changes in Size and Toughness of High-Carbon High-Chromium Steels Due to Subzero Treatments. L. E. Gippert and G. M. Butler, Jr. *Steel Processing*, v. 33, March 1947, p. 175-178.

Subzero treatment of these steels during the hardening operation causing considerable expansion within the metal. Some data on impact tests. Three common types of high-carbon high-chromium die steel were used in study.

18-72. Don't Overlook "Cold Treating." G. M. Butler. *Steel Horizons*, v. 9, no. 2, 1947, p. 10-12.

Application of subzero treatment to three high-carbon high-chromium die steels which have been found particularly responsive to this chilling. Details of the technique used.

18-73. Tool Steels. Part III. L. Sanderson. *British Steelmaker*, v. 13, March 1947, p. 147-150.

Instructions for the heat treating and annealing of the different types of high speed and special alloy tool steels. (To be continued.)

18-74. Durcissement Superficiel des Aciers par Diffusion Intersolide Suivie de Nitruration. (Superficial Hardening of Steels by Means of Intersolid Diffusion Followed by Nitriding.) Jean-Dominique Venturini. *Comptes Rendus*, v. 224, Jan. 13, 1947, p. 118-120.

Proposes to increase the surface hardness of plain carbon steels by intersolid diffusion at temperatures in the range 850 to 950° C., by placing in contact with steels containing ferro-aluminum or other ferro-alloys with titanium, molybdenum, tungsten, and vanadium, followed by nitriding.

18-75. Logging Trailers That Can Take It. *Linde Tips*, v. 26, April 1947, p. 50-51.

How flame hardening doubles life for half-tracks. Three flame hardening methods used.

18-76. Tratamentos Termicos Comerciais. (Commercial Heat Treatments.) Vicente Chiaverini. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 117-141; discussion, p. 141-142.

The various methods and equipment used in heat treatment of metals and their most common applications. A short review of the Heat Treatment Symposium of the Institute de Pesquisas Technologicas. 11 ref.

18-77. Induction Heating. (Concluded.) E. May. *Iron and Steel*, v. 20, March 1947, p. 117-120.

Machines for surface hardening, progressive hardening, brazing and soldering. How and where they may be used.

18-78. Principles of High-Frequency Heating. R. Smith. *Welding*, v. 15, March 1947, p. 108-115.

The principles of high-frequency heating, the types of plants employed and the design of the heating coils. Technique for various soldering and brazing applications.

18-79. High-Frequency Induction Treatment and Its Application to Ferrous Metals. R. J. Brown. *Sheet Metal Industries*, v. 24, March 1947, p. 598-602.

Deals only with surface heating. Basic electrical principles of induction heating; types of generators; spark-gap and electronic generators; economies of induction heating; power concentration; and inductor systems. (To be concluded.)

18-80. Martempering. *Machinery (London)*, v. 70, March 13, 1947, p. 265-266.

The process and its function.

18-81. Subzero Temperatures in Treating and Assembling Metal Parts. G. B. Olson. *Machinery*, v. 53, April 1947, p. 149-156.

How subzero temperatures are used to further harden steels after heat-treatment, to retard age hardening of aluminum, to shrink-fit parts for assembly and to cool tools during metal-cutting operations.

18-82. Heat Treating Aircraft Engine Parts at Pratt & Whitney Kansas City Plant. Part III. *Industrial Heating*, v. 14, April 1947, p. 557-558, 560, 562, 564, 566.

Pit-type carburizing furnaces and auxiliaries, oil-type tempering furnaces, an electric nitriding furnace, and miscellaneous equipment.

18-83. Modified Isothermal Treatments Minimize Distortion. O. E. Brown. *Iron Age*, v. 159, April 17, 1947, p. 54-56.

Heat treatment cycles for two carburized nickel steel parts, a herringbone pinion, and a gear having a light web and a hollow shaft. Isothermal treatments utilized, and modifications of present conventional practice have been successful in holding distortion to an exceptionally low value with no sacrifice in surface hardness. Core hardness has also been controlled without affecting the case.

For additional annotations indexed in other sections, see:
3-96-102-106; 4-47; 16-37-41-43-44-51-52.

19 WORKING — Rolling, Drawing, Forging

19-89. Cupping 27% Chromium-Iron. Carter C. Higgins. *Metal Progress*, v. 51, March 1947, p. 443.

How cups several diameters long of the above material are cold drawn at Worcester Pressed Steel Co.

19-90. Blanking, Piercing and Forming. J. W. Sladden and H. S. Walker. *Metal Industry*, v. 70, March 7, 1947, p. 143-145.

The methods employed in the development of zinc alloy press tools for the fabrication of sheet metal parts by the Bristol Aeroplane Co., Ltd. (Paper pre-

(Turn to page 38)

Pointers in Dealing With People Given

Key Methods of Minimizing Stresses and Strains in Dealing With People Are Displayed by Signs at a Joint Meeting of the Peoria Chapters A.S.M. and A.S.T.E. Holding the signs, left to right, are D. J. Wright, A.S.M. chairman; C. A. Woodley of Caterpillar Tractor Co.; Donald Laird, the speaker; and C. B. Hartsock, A.S.T.E. chairman

Reported by A. G. Phillips
Caterpillar Tractor Co.

People as well as metals have their stresses and strains, according to Donald A. Laird, noted psychologist, author and humorist. One of the big jobs of and engineer, he said, is to get the cooperation of the people. Cooperation cannot be bought; it must be earned.

Dr. Laird addressed 299 members and guests of a joint meeting of the Peoria Chapters of A.S.M. and the American Society of Tool Engineers. He enumerated some of the pegs upon which good relations must hang, as follows:

1. Ask questions. Get the dope from the other fellow; let him show his hand; ask an opinion to gain confidence.
2. Be brief. Don't "fuddy-duddy"; stay on the point. You don't need many words, and besides it's healthier to breath through your mouth.
3. Display a confident manner. Pretend you have it if you don't; shake hands as though you mean it; increase your confidence by increasing your ability and saving your money.
4. Be direct when you look at people; you can also have directness when you listen.
5. Be earnest. Drop the funniness and show earnest enthusiasm and sincerity when the time comes.
6. Be friendly no matter who they are, what they are, or where they are; turn down in a friendly way; be of use to your friends.

Buffalo Has President's Night

Reported by G. F. Kappelt
Assistant Metallurgist, Bell Aircraft Corp.

National President's Night was celebrated by the Buffalo Chapter ⊜ at its April meeting. Mr. Boegehold delivered his excellent talk on the "Correlations of Recent Data on Hardenability". This talk has been reviewed earlier in the season. Before the formal dinner meeting, which was attended by nearly 100 members, Mr. Boegehold was entertained at a Republic Steel Corp. cocktail party.

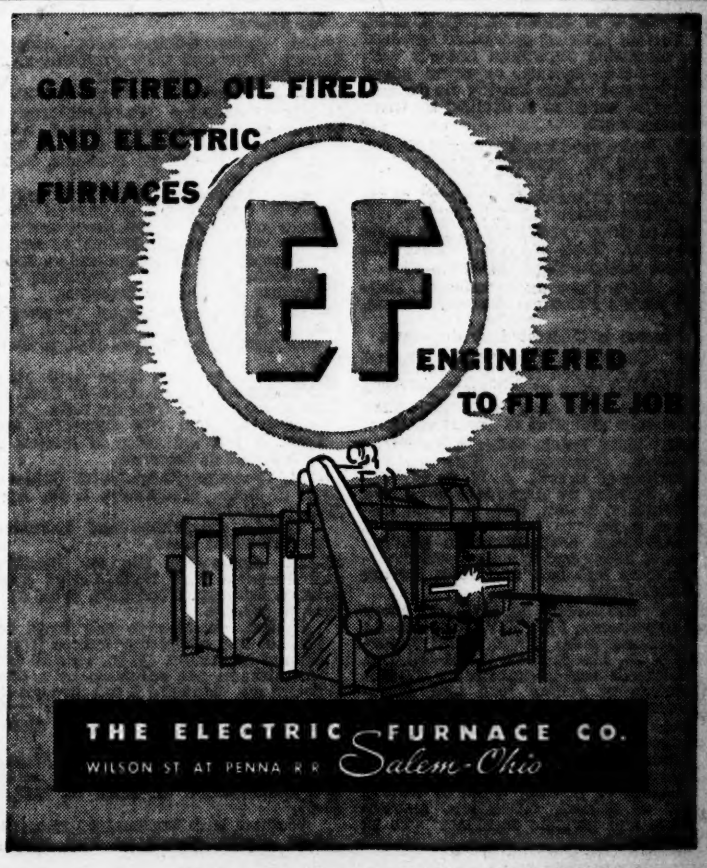
Specific Examples Illustrate Fabrication of Stainless

Reported by E. T. Carlson
Isaacson Iron Works

E. Von Hambach, research and development engineer of the Carpenter Steel Co., Reading, Pa., addressed a recent meeting of the Puget Sound Chapter ⊜ on "The Correct Application and Fabrication of Stainless Steel in Industry". Mr. Von Hambach opened his talk with a summary of the chemical and physical properties of the various types of chromium-nickel and straight chromium stainless steels.

By specific examples Mr. Von Hambach showed how necessary it is to study fabrication methods in order to meet competition. For the successful machining of stainless steels proper supervision of tool grinding is advisable, and the right cutting oils must be used. Hardness of the material to be machined is important; too soft a material is more difficult to machine than a steel of a selected hardness. Electrolytic polishing in production, he mentioned, is only successful on wire products or small nonsymmetrical articles.

An ample supply of actual fabricated parts illustrated the address and represented many of the commonly accepted applications of stainless steel which are a direct result of Mr. Von Hambach's research and development.



sented before the Sheet and Strip Metal Users' Technical Association. To be continued.)

19-91. Moldings by the Mile at Herron-Zimmers Moulding Co. P. D. Aird. *Modern Industrial "Press"*, v. 9, March 1947, p. 13-14, 18, 42.

Equipment and procedures employed for various parts produced.

19-92. Deep Drawn Magnesium Parts Save Weight. R. G. Gillespie. *Materials & Methods*, v. 25, March 1947, p. 86-89.

How an oil filter, part of an aircraft de-icing system, was designed for fabrication from magnesium by deep drawing. Canoe and wheelbarrow as examples of large-sized work done in magnesium alloys by press-forming.

19-93. Loading-Unloading Fixture for Presses. Kenneth Rose. *Materials & Methods*, v. 25, March 1947, p. 132.

Device consists of a slotted circular disk revolving horizontally about a center on the press table; it is so positioned as to bring the workpieces under the ram of the press at some station in the circle. The workpieces fit into slots in the disk. The motion of the disk is controlled to move the disk through a fraction of a revolution equal to the number of slots provided.

19-94. Mechanical Cold Drawbenches for Ferrous and Non-Ferrous Tubes. G. W. Garwig and A. L. Thurman. *Blast Furnace and Steel Plant*, v. 35, March 1947, p. 348-354, 356.

Describes drawbenches and gives a brief history of their development. Various components.

19-95. Discussion of Mill Motor Standards. Frank W. Cramer. *Iron and Steel Engineer*, v. 24, March 1947, p. 67-71; discussion, p. 71-78.

Proposed increase in power of rolling-mill motors for given motor-frame sizes.

19-96. Tool Design Streamlines Drawing Practice. G. W. Birdsall. *American Machinist*, v. 91, March 27, 1947, p. 77-81.

Various drawing operations involved in producing aluminum utensils with triple-thick bottoms, requiring heavy ironing and unique bulging die designs. Sidewall hardness is doubled by three ironing steps.

19-97. Rules for Drawing Round Shells. Parts I and II. *American Machinist*, v. 91, March 27, 1947, p. 135, 137.

A draw reduction table which offers a simple means of determining per cent of draw reduction and flat blank diameter. Table can only be used with round straight-sided shells or cups.

19-98. Deep Drawing Aluminum. *Reynolds Metals Technical Advisor*, v. 1, no. 3, p. 1.

Process is illustrated by drawings.

19-99. Service to the West. *Western Metals*, v. 5, March 1947, p. 36-39.

Pictorial story of Pacific Tube Co.—the first and only privately-owned steel tube mill west of the Rockies.

19-100. Nota Prévia Sobre a Producao de Invar. (Preliminary Note on the Production of Invar.) A. H. de Silveira Feijo. *Boletim da Associacao Brasileira de Metals*, v. 3, Jan. 1947, p. 79-93; discussion, p. 94.

Difficulties encountered in production of ingots and in rolling and drawing them into bars and wires for use as standards.

19-101. The Rolling of Metals: Theory and Experiment. Part XIV. (Continued.) L. R. Underwood. *Sheet Metal Industries*, v. 24, March 1947, p. 531-538, 540.

Methods used in practice for the calculation of rolling load and horsepower. (To be continued.)

19-102. Practical Problems of Light Presswork Production. (Continued.) J. A. Grainger. *Sheet Metal Industries*, v. 24, March 1947, p. 549-552.

Rating of presses; types of clutch; care of presses, lubrication, maintenance and periodic checking. (To be continued.)

19-103. The Development of Zinc Alloy Tools for Blanking, Piercing and Forming Sheet Metal Parts. J. W. Sladden and H. S. Walker. *Sheet Metal Industries*, v. 24, March 1947, p. 567-581, 586; *Aircraft Production*, v. 9, March 1947, p. 115-119.

The various aspects of tooling for the drop hammer and stretcher press. A method developed for blanking light alloy metals by means of zinc alloy, and use of zinc alloy in manufacturing press tools for deep drawing on double-action presses, as applied to short-run manufacture of motor-car body panels.

19-104. Blanking, Piercing and Forming. (Continued.) J. W. Sladden and H. S. Walker. *Metal Industry*, v. 70, March 21, 1947, p. 183-185.

Discussion of development of zinc alloy tools for sheet-metal parts. (To be continued.)

19-105. Hot Rolling. Henry Vita. *Metal Industry*, v. 70, March 21, 1947, p. 193.

Notes on the production of light-alloy slabs.

19-106. Blanking, Piercing and Forming. (Continued.) J. W. Sladden. *Metal Industry*, v. 70, March 28, 1947, p. 203-205.

Development of zinc alloy tools for sheet-metal parts. (To be concluded.)

19-107. Mechanical Cold Drawbenches for Ferrous and Nonferrous Tubes. Part II. G. W. Garwig and A. L. Thurman. *Blast Furnace and Steel Plant*, v. 35, April 1947, p. 461-466.

The electrical equipment used in connection with the drawbenches manufactured by Aetna-Standard Engineering Co.

19-108. Progressive Metalworking Dies Increase Output of Stampings. Gerald Eldridge Stedman. *Production Engineering & Management*, v. 19, April 1947, p. 78-81.

Production rate of 125 small, precise parts per minute is being obtained at Knapp-Monarch with five-stage progressive dies on high-speed metalworking presses.

19-109. Sectional Rope Units. Richard Saxton. *Wire and Wire Products*, v. 22, April 1947, p. 284-285, 316-317.

The processes of their production.

19-110. Preventive Maintenance of Spring Coiling Machines and Some Spring Coiling Experiments. C. R. Bergevin. *Wire and Wire Products*, v. 22, April 1947, p. 288-292.

Some production faults that may be encountered and the manner in which the troubles may be run down and corrected or prevented. Details of certain experiments to find ways and means of increasing the general usefulness and capacity of standard machines.

19-111. A High-Production Progressive Die. F. E. Baldwin and H. Effgen. *Tool & Die Journal*, v. 13, April 1947, p. 70-72, 144.

A die into which three $\frac{7}{32}$-in. strips of aluminum sheet stock of 0.038 in. thickness are fed from the right. After passing through five successive stations, a finished piece is ejected at each stroke of the press.

19-112. Forming Sheet-Metal Cabinets. Cyril J. Bath. *Machinery*, v. 53, April 1947, p. 184-187.

Various machines and operations performed on them.

19-113. Compound Die for Blanking and Forming Part With Curled Edge. John E. Hallberg. *Machinery*, v. 53, April 1947, p. 193-194.

Ribbed, curled-edge ash trays are blanked and completely formed from a strip of aluminum, 4⅛ in. wide by 0.012 in. thick, in one operation by a compound die. Material is fed through the die continuously, from left to right, and the formed ash trays are ejected by compressed air.

19-114. Press Forms Four-Part Magnesium Canoe. Chester S. Ricker. *American Machinist*, v. 91, April 10, 1947, p. 96-97.

Pictures with explanatory notes tell how sheets, extrusions, and castings make 16-ft. unit weighing less than 50 lb.

19-115. Fundamentals of Forging. Anderson Ashburn. *American Machinist*, v. 91, April 10, 1947, p. 109-124.

Methods of forging and the equipment and dies that are used.

19-116. "Fluid Punch". *Steel*, v. 120, April 14, 1947, p. 90-91, 118.

Use of one die section and water under high pressure in place of mechanical punch characterizes process which permits the drawing of difficult shapes in single operation.

19-117. Six-Stage Progressive Die Operation. *Steel*, v. 120, April 21, 1947, p. 88-89, 135.

Produces entire blade sections for multivane centrifugal-blower wheels, cutting costs by 30%.

19-118. Forming Magnesium Alloys. Allen G. Gray. *Steel*, v. 120, April 21, 1947, p. 91, 126, 128, 130, 132, 134.

Main difference in the tools and technique is necessitated by the fact that many forming operations must be performed at elevated temperatures, due to a close-packed hexagonal crystal structure. (To be continued.)

19-119. Cold Extrusion. *Federal Science Progress*, v. 1, May 1947, p. 35-37.

Cold extrusion of steel as developed in Germany during the war. Bonderizing the surface facilitates the process. Possibilities of application in U. S.

For additional annotations indexed in other sections, see:

4-36; **14**-107; **16**-50; **18**-66; **20**-163; **22**-170-180; **23**-97-101-109; **24**-95-98-107-110; **25**-57; **27**-85-88.

20 MACHINING AND MACHINE TOOLS

20-155. Wet Belt Machining Method. William F. Schleicher. *Aluminum and Magnesium*, v. 3, Feb. 1947, p. 8-10, 20, 22.

Various operations performed by this method. Principles of wet belt machining and information on jigs, fixtures, and coolants.

20-156. Machining and Machinability. Francis W. Boulger. *Metals Review*, v. 20, March 1947, p. 5-8, 51.

Developments in practices, tests, and theories reflected by recent technical literature. Machines and tools; negative-rake tools; shaving, hobbing, honing; crush-dressing; abrasive-belt grinding; high speed band sawing; machinability; metal cutting theory.

20-157. Machine Tools and Tool Materials as Described by the Manufacturers. *Metals Review*, v. 20, March 1947, p. 9-12.

New products and equipment for metal cutting developed during the past 12 months. Emphasis is on metallurgical developments in machining operations rather than construction and operation.

20-158. Automatic Lathe Speeds Cutoff Operations. *Iron Age*, v. 159, March 27, 1947, p. 47.

Hydralectric automatic lathe is designed to fill the demand for a high-production machine for chamfering and cutting-off a large variety of parts made from pipe, tubing, or solid bar stock.

20-159. Air-Operated Eccentric Fixture Simplifies Broaching. *Iron Age*, v. 159, March 27, 1947, p. 52.

Simplifies the broaching of keyway slots in the bores of heavy-duty steering knuckles. Also eliminates the necessity of loading the part over the broach. Machine described is a 10-ton Colonial utility hydraulic press equipped with a standard Colonial pull-down broaching attachment.

(Turn to page 40)

Importance of Fully Hardened Martensitic Structure Emphasized by Kinzel

Reported by Dow M. Robinson
New England Metallurgical Corp.

The importance of obtaining a completely martensitic structure through a section of hardened steel was stressed in a talk on "Alloying Additions to Steel", before the Boston Chapter on March 7. A. B. Kinzel, vice-president of Union Carbide & Carbon Research Laboratories, Inc., was the speaker.

Dr. Kinzel pointed out that mechanical soundness of steel is determined by oxygen content. However, other impurities besides oxygen are detrimental, for the degree of solubility is one of the most important frontiers of our research today, out of which will come still cleaner steels.

The theory that one should be satisfied with an as-quenched hardness of Rockwell C-50 in an alloy steel, when the ultimate hardness desired after tempering is only C-40, is erroneous. By starting with a *fully* hardened martensitic structure and tempering much higher to attain the same resulting hardness of C-40, much greater toughness is attained. It is essential to increase the alloy content in conjunction with the increasing size or mass of the steel in order to obtain a wholly martensitic structure throughout.

Hardness of martensite is a function of carbon content. This truth has not yet penetrated the metallurgical world, according to Dr. Kinzel. Another factor might well be considered in adding alloys to insure complete hardenability of martensitic structure throughout, and that is the unit cost of these alloy combinations in determining the dollar value of hardening power.

Proper tempering of a completely martensitic structure results in a steel of high ductility for a given strength, Dr. Kinzel emphasized. While his talk centered around this point, he also mentioned improved tools developed to promote the making of better steels; such as new microscopes, X-ray, spectroscope and radioactive materials.

The future metallurgist must not only be familiar with metallurgy, but should be a scientist, an engineer and a mathematician and should have a working knowledge of physical chemistry, according to the speaker.

Prof. John Chipman, head of the department of metallurgy at M.I.T., acted as technical chairman and directed the discussion. Immediately following dinner, Henry R. Spedden, assistant professor of metallurgy at M.I.T., presented an interesting and informative coffee talk entitled "Mining in Bavaria Under the Army of Occupation". Professor Spedden was an officer in the Corps of Engineers and acted as mine manager in Bavaria for some time.

At Boston Chapter's March Meeting Are, Left to Right, H. R. Spedden, Coffee Speaker; John Chipman, Technical Chairman; A. B. Kinzel, Principal Speaker; and C. G. Lutts, Chapter Vice-Chairman. (Photo by H. L. Phillips)

Baltimore Meets With Foundrymen's Association

Reported by Russell L. Wilcox
Bethlehem Steel Co.

Baltimore Chapter held a joint meeting with the Chesapeake Chapter, American Foundrymen's Association, in March. The members of both organizations turned out to the tune of 127 persons for dinner, augmented to approximately 200 for the technical session.

Clarence H. Lorig of Battelle Memorial Institute spoke on "Cast Metals", and Max Kuniansky, national president-elect of A.F.A., led an interesting discussion at the conclusion of Dr. Lorig's paper.

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20-160. How to Use Carbide Cutters for Milling. Part VII. H. A. Frommelt. *Iron Age*, v. 159, March 27, 1947, p. 58-62.

Semisteel, alloy cast iron and ni-resist can now be milled at a high rate of speed and with excellent tool life by the proper application of carbide cutters. Examples taken from actual shop practice; the difference in technique for machining these materials, as compared with regular cast iron, and optimum machine and cutter settings.

20-161. Special Tool Designed for Reaming Punches. Robert Mawson. *Materials & Methods*, v. 25, March 1947, p. 132-133.

Tool developed to manufacture a quantity of punches made of tungsten steel, when specifications called for the hole to be perfectly straight and with no tool marks.

20-162. Good Fixtures Make Broaching Suitable for Many Jobs. Harry H. Gotberg. *American Machinist*, v. 91, March 27, 1947, p. 90-92.

Variety of setups that can be made to work on standard equipment.

20-163. Hard Faced Dies Make Drums. John A. Gallaher. *American Machinist*, v. 91, March 27, 1947, p. 101-103.

How record production has been attained with hard faced forming and cutting tools in fabrication of steel containers for dry materials.

20-164. Practical Ideas. *American Machinist*, v. 91, March 27, 1947, p. 111-116.

Horizontal crank press swages tubes automatically. Toggle-clamp base makes vernier height gage. Cutoff fixtures improve pin and screw production. Flit-gun vacuum principle ejects small slugs. Hints on small tools. Radius-turning tool requires minimum machining. Straightedge tester gives complete graphic record. Combination reamer saves two turret steps.

20-165. Thrust Loads in Drilling Various Metals. *American Machinist*, v. 91, March 27, 1947, p. 139.

Tables give feed in inches per revolution for cast iron, machine steel, cast steel and carbon steel.

20-166. Method of Drilling and Tapping Carbides to Expand Their Applications. *Steel*, v. 120, March 31, 1947, p. 94.

Process in which machinable materials are solidly embedded in the carbide parts wherever the parts are to be drilled or tapped.

20-167. The Surface Broaching Operation in the Field of Metal Machining. George Squibb. *Modern Machine Shop*, v. 19, April 1947, p. 168-170, 172, 174, 176, 178, 180.

Various broaching machines and operations performed on them.

20-168. Ideas From Readers. *Modern Machine Shop*, v. 19, April 1947, p. 212, 214, 216, 218-220, 222.

Novel tool cabinet. Cutting groove in special arbor. Simplified pin measurement method for gibs and dovetails. Facing sea-chest flange with radial drill.

20-169. Bevel Gears. G. W. Nash. *Automobile Engineer*, v. 37, Feb. 1947, p. 71-76.

Production and testing of bevel gears of all types. Characteristics of the various types and the importance of accurate machining of blanks. The Revacycle machine for producing straight bevels and machines for producing spiral bevel, Zerol, and Hypoid bevel gears. Grinding and lapping operations; chucking equipment; and testing devices.

20-170. Investigation of the Lapping Process. Part II. F. Eugene. *Industrial Diamond Review*, v. 7, March 1947, p. 67-71.

Concludes report on an extensive comparative study of different lapping abrasives and materials. Includes a comparison between smooth and grooved laps. Photomicrographs of the different lap metals used are presented. (Condensed from *Travaux et Memoirs du Laboratoire des Industries Mecaniques*, v. 2, 1945, p. 9-33.)

20-171. Simplified Formulas for Grinding and Checking Tapers. Charles L. Hall. *Production Engineering & Management*, v. 19, April 1947, p. 75.

Formulas given will be found useful in toolrooms when taper plug gages and taper ring gages are being processed. They would prove to be of value on shop work involving unknown dimensions for tapers.

20-172. Machine and Tool Engineering. *Production Engineering & Management*, v. 19, April 1947, p. 76-77.

Includes the following brief items by separate authors: Fly Cutting Bored Holes; Cam-Operated Crowning Unit; Handling of Gear Blanks.

20-173. Production Data Sheet. *Production Engineering & Management*, v. 19, April 1947, p. 83.

Practical tool speeds for average work.

20-174. A Tooling Program for Forged Globe Valves. Part VI. Carl F. Benner. *Tool & Die Journal*, v. 13, April 1947, p. 73-78, 133.

The machining operations on the packing cap used on Parker globe valves.

20-175. Machining With Precision Saw Blades. H. J. Chamberland. *Tool & Die Journal*, v. 13, April 1947, p. 79-81.

Case histories of various laboratory tests to determine the correct type of saw, velocity, and work pressure that will produce a maximum cutting rate consistent with tool life.

20-176. Twenty-Five Single Point Tool Operations at One Setup. *Tool & Die Journal*, v. 13, April 1947, p. 82-84.

Eight-position turret lathe designed for turning, boring, or threading parts up to 6 in. in diameter which have been blanked out on automatic screw machines or turret lathes; or for finishing stampings, castings, forgings, and many other types of work that ordinarily require many individual setups.

20-177. Fast Jig and Fixture Setups. *Tool & Die Journal*, v. 13, April 1947, p. 85-88.

Speed Jig is made up of a small and simple variety of elementary but precision-made members that can be easily and accurately assembled into an unlimited variety of jig and fixture patterns for the economical small-lot production of interchangeable parts requiring the drilling and reaming of such hole layout patterns as circular, square, rectangular, or irregular, in one or more planes.

20-178. Thread Rolling Steel Parts on the Automatic Screw Machine. E. P. Ranney. *Screw Machine Engineering*, v. 8, April 1947, p. 33-38.

Sequence of operations on 1-in. RA6 Acme Gridley bar machine featuring the even spread of tooling over the six end working positions and roll threading which makes it possible to produce part complete at a single setup.

20-179. Where Do You Stop in Applying Cam Technique? *Screw Machine Engineering*, v. 8, April 1947, p. 40-41, 44-45.

Secondary operation work on the Brown & Sharpe automatic. Job is processed until an inexpensive, though highly productive, tooling arrangement is reached. Camming technique which, when understood, can be profitably applied without increasing cost of tooling the job.

20-180. Hardinge Multi-Operation Chucking Machine. *Screw Machine Engineering*, v. 8, April 1947, p. 57-60.

Some of its outstanding features.

20-181. Kennamilling. H. A. Frommelt. *Tool Engineer*, v. 18, April 1947, p. 23-27.

The technique of milling as resulting from the union of a carbide, suited to metal removal according to the milling process, and a suitable tool holder. Examples and economies.

20-182. Precision Lapping by the Centerless Method. Peter L. Sommer, Jr. *Tool Engineer*, v. 18, April 1947, p. 33-34.

Simple but positive operating principle produces uniform precision finish to less than 2 microinches.

20-183. Drilling and Boring Tools. *Tool Engineer*, v. 18, April 1947, p. 57-58.

An application of a bushing installation used when a drilled hole is to be followed by a tapping or reaming operation. The drill bushing is mounted in a receding cage, and enters a bushing in the jig which is of sufficient i.d. to clear the next tool. An application is shown for two-station fixture, where a part is first drilled in one of the two spindles of a two-spindle drill press, and then moved to the other spindle for tapping.

20-184. The Manufacture of Automobile Springs and Bumpers From Raw Material to Finished Stock. John B. Rauen. *Western Metals*, v. 5, April 1947, p. 18-21.

An account of production at U.S. Spring & Bumper Co.

20-185. Carbides on Railroad Jobs. Part I. Carroll Edgar. *Railway Mechanical Engineer*, v. 121, April 1947, p. 189-195.

Various factors that influence the use of carbide tools on the jobs and machines usually found in the average shop.

20-186. Operation of an Engine Lathe. *Machine and Tool Blue Book*, v. 43, April 1947, p. 135-140, 142, 144, 146.

Parts of a lathe that hold the workpiece and control its motion or rotating speed.

20-187. Using Carbides in Metalworking. H. A. Frommelt. *Machine and Tool Blue Book*, v. 43, April 1947, p. 147-148, 150, 152, 154, 156.

Procedure used to mill a steel component 2x4x20 in. using a milling machine which had been considered too light for carbide milling.

20-188. Multiple Tool Holder Attached to Shaper Solves Machining Problem. Gerhardt P. Niesel and Herbert R. Steidtmann. *Machine and Tool Blue Book*, v. 43, April 1947, p. 185-190.

Use and construction of the multiple tool holder.

20-189. Modern Centerless Grinding Practice. Part III. D. E. Lower. *Machine and Tool Blue Book*, v. 43, April 1947, p. 199-200, 202, 204, 206, 208, 210-213.

The proper selection of grinding wheels and the necessity for plenty of coolants. Table of grinding-wheel recommendations for specific jobs and materials.

20-190. Thrust Loads Due to Drilling Various Metals. *Machine and Tool Blue Book*, v. 43, April 1947, p. 282.

Table covers cast iron, machine steel, cast steel, and carbon steel.

20-191. Ingenious Equipment Used in Making Split Bushings at a Ford "Hydro" Plant. Charles H. Wick. *Machinery*, v. 53, April 1947, p. 141-146.

Manufacturing methods and ingenious machinery used in producing split-type valve guide bushings.

20-192. Rotary Power Filing Technique. *Machinery*, v. 53, April 1947, p. 165-167.

Types of rotary files and burrs; methods of selecting them; operating speeds for various metals.

20-193. Superfinishing Methods and Applications. Part II. E. L. Hemingway. *Machinery*, v. 53, April 1947, p. 168-171.

Typical applications of the superfinishing process on bearings and shop tools, and for inspection work.

20-194. Diamond or Crush-Dressed Wheels for Contour Grinding? Fred Victory. *Machinery* v. 53, April 1947, p. 172-177.

Factors determining the choice between diamond-dressing and crush-dressing a wheel for contour grinding. Advantages and applications of each method.

(Turn to page 42)

National President Welcomed Home

Left to Right: Walter G. Patton, Chairman of the Detroit Chapter; National President Alfred L. Boegehold; and Walter E. Jominy, National Trustee and Technical Chairman

Reported by D. J. Henry
General Motors Research Laboratories

Detroit Chapter members took the occasion of National Officers' Night to welcome home President A. L. Boegehold and to give him due recognition for his achievements in the field of metallurgy. Long active in A.S.M. affairs, Boegehold is also a past chairman of the Detroit Chapter.

Mr. Boegehold's address "Correlation of Recent Data on Hardenability" aroused the interest of metallurgists who are concerned with securing reproducible performance in the heat treatment of the same grade of steel from heat to heat. Need of narrowing the hardenability bands of the H-steels in many applications was pointed out. Discussion following the paper especially reflected interest in the practice of buying steel on hardenability specifications. Details of the lecture have been previously reported in *Metals Review*.

Hughes Retires, Was With New Departure 36 Years

Frederick G. Hughes, a past national president, and vice-president of General Motors Corp. and general manager of its New Departure Division at Bristol, Conn., has retired after 36 years of association with New Departure.

F. G. Hughes

He has been a top executive of New Departure since 1911 when he started at the plant in the post of chief engineer. He became assistant general manager in 1914, and was named general manager in 1933 when New Departure became a division of General Motors. He was elected vice-president of the corporation in January 1947.

Mr. Hughes is a graduate of the Sheffield Scientific School of Yale University (1900). At the outbreak of World War II he was president of the Anti-Friction Bearing Association, and acted as chairman of that organization's defense committee in the immediate prewar and war years. The development of the basic analysis of high-carbon chromium steel for ball bearing manufacture, and the procedure for spheroidize annealing of steel, have been largely credited to him.

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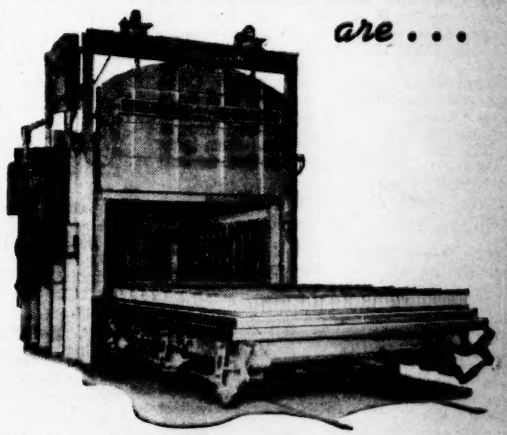

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20-195. Production "Firsts" at Plymouth's Enlarged Plant. Joseph Geschelin. *Automotive and Aviation Industries*, v. 96, April 1, 1947, p. 28-32, 78, 82, 84.

A comprehensive study of accomplishments by Plymouth management in creating an advanced-type plant for mass production of passenger cars.

20-196. Modern Band Sawing Practice. H. J. Chamberland. *Iron Age*, v. 159, April 17, 1947, p. 64-66.

Technique and detailed information on friction sawing, in which velocities as great as 15,000 ft. per min. are used in steel.

20-197. How to Use Carbide Cutters for Milling. Part VIII. H. A. Frommelt. *Iron Age*, v. 159, April 10, 1947, p. 78-81.

Various factors which govern the life of a carbide cutter. Actual wear on the various edges and its causes; chipping and breakage. Selection of various grades of carbide for different jobs; optimum feed rates; a method of selecting feed rates to suit varying conditions.

20-198. How to Use Carbide Cutters for Milling. Part IX. H. A. Frommelt. *Iron Age*, v. 159, April 17, 1947, p. 58-63.

Some practical applications of the factors governing cutter life together with information on cutter design, types of blades, and grinding technique.

20-199. Novel Tools Cut Cost of Gear Sector. Kenneth F. Brooks. *American Machinist*, v. 91, April 10, 1947, p. 93-95.

How 2000 close-grain iron gear-sector castings are machined each day. Only five machining and one subassembly operation are necessary to prepare 1½-lb. castings for delivery to the assembly line. Except for the Kingsbury drilling and reaming machine, all machines in group are general-purpose units, special tooling being employed to increase machining efficiency.

20-200. What AC Learned in Broaching Two Parts. Rupert Le Grand. *American Machinist*, v. 91, April 10, 1947, p. 100-101.

Two parts manufactured by AC Spark Plug Division, General Motors Corp., provide case examples of broach development. Design details and pertinent features.

20-201. Practical Ideas. *American Machinist*, v. 91, April 10, 1947, p. 135-140.

Single indicator setting tests inserted cone cutters. Angle table speeds cutter rake-angle grinding. Small thread and gear-measuring pin technique. High-speed assembling fixture cuts noise and lost motion. Three-legged plug gage has wide adjustability. Contour-milling device uses cam and one-way clutch. Keyed broach maintains accurate alignment. Centered bronze lap trues universal chucks. Jam nuts make free-swiveling compound do ball turning.

For additional annotations indexed in other sections, see:
3-113; 7-150; 12-67-69; 23-97-112; 24-96-100-108-114-115; 25-52; 26-64; 27-67-71-72-88.

21 LUBRICATION and Friction; Bearings

21-37. Analysis of Centralized Lubricating Systems. James P. Gravenstreter. *Iron and Steel Engineer*, v. 24, March 1947, p. 81-89, 97; discussion, p. 97.

Nine systems of centralized lubrication.

21-38. Oil Purification, Filtration and Reclamation. Brian Corrigan. *Iron Age*, v. 159, April 3, 1947, p. 56-62.

The characteristics of used oil; the various methods which may be used for purifying, filtering, or reclaiming it; advantages and disadvantages of each method.

21-39. Advances in Ball and Roller Bearings. Fred W. Mesinger. *Engineers' Digest (American Edition)*, v. 4, March 1947, p. 98.

Wartime advances in instrument bearings; extra light, low weight bearings; high-temperature bearings; sealed ball bearings; improved greases for bearing lubrication; improved protection of bearings in shipment; bearing standardization.

For additional annotations indexed in other sections, see:
3-102; 8-58; 23-121; 27-83.

22 WELDING Flame Cutting; Riveting

22-160. Chemical Composition of Austenitic Welding Electrodes. Richard K. Lee. *Metal Progress*, v. 51, March 1947, p. 445-447.

Study of 171 heats of 18-8 electrode wire showed that to avoid root cracks in weld metal the chromium must be at least twice the nickel, and the carbon and the phosphorus both at practicable minimums. Nitrogen induces crack sensitivity in weld metal from higher alloy (25% Ni, 12% Cr).

22-161. City Gas and Oxygen Mixture Effective in Flame Cutting Steel. *Steel*, v. 120, March 24, 1947, p. 77.

Steel plates from thinner gages up to 12 in. in thickness are cut to pattern in varying quantities. The clean, square edges resulting are said to be relatively free from kerf marks and oxidized material, thus requiring little or no machining. Illustrations show the start of a cut in 2¼-in. thick 15-20 steel with a 530-B.t.u. manufactured gas-oxygen mixture and No. 2 Harris-Calorific burner tip; the cut over halfway across the slab after 2 min., and the severed face of a slab.

22-162. Powder Cutting and Scarfing of Oxidation Resistant Materials. D. H. Fleming, Jr. *Welding Journal*, v. 26, March 1947, p. 201-208.

Techniques and applications of these methods to stainless steels.

22-163. Development and Applications of Lime-Ferritic Electrodes. D. L. Mathias and A. P. Bunk. *Welding Journal*, v. 26, March 1947, p. 209-217.

The properties and the chemistry and metallurgy of organic and mineral electrodes. Results of tests comparing the low-temperature impact properties of welds using E-6020 and lime ferritic electrodes.

22-164. Spot Welding Under Water. Charles L. Coomer. *Welding Journal*, v. 26, March 1947, p. 217-218.

Techniques developed by American Air Filter Co. for spot welding of the impeller blades of the turbine-like apparatus manufactured by the company.

22-165. Building Code Requirements for Welding Structural Steel. Simon A. Greenberg. *Welding Journal*, v. 26, March 1947, p. 219-222.

A survey of codes in 205 cities having a population of 50,000 or more.

22-166. Choice of Cable and Transformer Size for Portable Spot Welders. Myron Zucker. *Welding Journal*, v. 26, March 1947, p. 233-238; discussion, p. 238-239.

Tables and charts which make it easy for the man on the job to determine which water-cooled cable should be used for a given job.

22-167. Cold Cracking in the Heat-Affected Zone. C. B. Voldrich. *Welding Journal*, v. 26, March 1947, p. 153s-169s.

The nature of the above phenomenon in metal-arc welds in steels, and the influence of steel properties and hydrogen from welding electrodes on the incidence of cold cracking. Data on the hydrogen-generating characteristics of various types of electrodes and on the influence on cracking of chemical composition and the distribution of carbon and alloying elements in steel. Application of this knowledge and techniques for comparing crack sensitivity of steels. 28 ref.

22-168. Discussion of Paper, "The Control of Weld Hot Cracking in Nickel-Chromium-Iron Alloys." R. David Thomas, Jr. *Welding Journal*, v. 26, March 1947, p. 190s-191s.

In discussion of paper by Kihlgren and Lacy in the Nov. 1946 issue, it is suggested that a tabulation of complete weld metal analyses would be useful. Also suggests going slow in introducing 5% or more Cb to high nickel-chromium weld metals other than 80% Ni, 14% Cr.

22-169. Case Histories Show Versatility of Resistance Welding. Joseph W. Kehoe. *Materials & Methods*, v. 25, March 1947, p. 77-81.

Examples of the intelligent application of resistance welding to achieve better products and reduced production costs.

22-170. "Press Welding" Aluminum for Aircraft Radiators. T. G. Haertel. *Materials & Methods*, v. 25, March 1947, p. 127.

Condensed account of method of welding and forming aluminum sheet used by the Germans during the war in the manufacture of aircraft radiators. Sheets of aluminum are virtually melted together between gas heated dies that are closed under pressure. When the dies are nearly closed, compressed air is injected between the sheets to blow open the areas between the rows of welds, in order to form passageways conforming to the design of the dies. (Condensed from Report No. 417 of Joint Intelligence Objectives Agency, 12 p.)

22-171. Metallic Joining of Light Alloys. Part III. *Light Metals*, v. 10, March 1947, p. 111-120.

Fluxes for soldering of aluminum, theory and practice of hard solders, and soldering for light alloys; the mechanical and corrosion properties of soldered joints.

22-172. Snow Flakes and Hairline Cracks in Weld Metal. M. Lefevre. *Engineers' Digest (American Edition)*, v. 4, March 1947, p. 131-135.

Conditions conducive to appearance of these defects in steels and weld metals; the influence of various factors such as hydrogen content, cooling rate, quenching temperature, tensile stresses, and chemical composition. Countermeasures. 14 ref. (Condensed from *Revue de la Soudure*, v. 1, no. 2, 1945, p. 39-49; *Arcos*, v. 23, July 1946, p. 2411-2429.)

22-173. The Arc Welding of Steel Aircraft Components. R. Smallman-Tew. *Welder*, v. 15, Oct-Dec. 1946, p. 79-80.

A successful changeover from gas welding to arc welding. "Oxford" undercarriage end fitting consists of three tubes of T45 material, 17 gage by approximately 1½ in. diameter, the short horizontal tube being offset 5° from the axis of the other two tubes.

22-174. Recent Examples of Welded Ship Structures. J. M. Stevenson. *Welder*, v. 15, Oct-Dec. 1946, p. 81-87.

The constructional details of one unit of a completely welded double bottom, part of a fully welded deck, an ordinary transverse watertight bulkhead, and a design for a large stern-frame.

(Turn to page 44)

Stainless Steel Properties Change With Temperature

Reported by M. W. Williams
Foundry Manager, Hughes Tool Co.

A stainless steel that is satisfactory at one temperature may not be serviceable at another temperature, Alexander L. Feild pointed out in addressing the Texas Chapter ⊕ on Feb. 18. Mr. Feild, who is associate director, research laboratories, American Rolling Mill Co., spoke on "Stainless and Heat Resisting Alloys".

Properties of the stainless steels, he said, often change as the service temperature increases. With the development of the gas turbine, designers are asking for steels which will have a longer life at high operating temperatures.

Mr. Feild discussed the need for better and faster methods of checking the various properties of the steels; months and even years are required to determine certain properties by present methods.

Curves were shown to illustrate the comparison of various stainless steels under certain conditions of corrosion and varying temperatures. Mr. Feild discussed the laboratory methods of determining the stress-rupture and creep properties of steel samples and pointed out the importance of this property to the design of highly stressed parts operating at high temperatures.

Uses of Ferromagnetism, Magnetic Recording Shown

Reported by Russell L. Wilcox
Bethlehem Steel Co.

James B. Austin, director of research, United States Steel Corp., speaking on "Ferromagnetism—Tool of Industry", cited the degaussing of ships as a protection against mines to demonstrate the effect of creating a magnetic field on an object.

Dr. Austin addressed the January meeting of the Baltimore Chapter ⊕. The coffee speaker, John Krantz of the University of Maryland Medical School, spoke on "Alcohol".

Dr. Austin described the principle of operation of the electromagnetic strain gage and reviewed some principles of magnetism, particularly the so-called hysteresis loop. A number of magnetic properties are useful in characterizing a piece of steel, and are used in magnetic inspection of steel, either for defects or for the separation of mixed lots.

Dr. Austin concluded his talk with a demonstration of magnetic recording on wire. He operated a portable recording machine which used cold drawn stainless steel wire, 0.004 in. in diameter. During the discussion period many of the members had their voices recorded on the machine.

Fisher Furnace Becomes Division of Lindberg

Lindberg Engineering Co., Chicago, and the Fisher Furnace Co., Chicago, have united their organizations according to an announcement by L. A. Lindberg, president of Lindberg Engineering Co.

L. A. Lindberg

Under the new arrangement the Fisher organization will be known as Fisher Furnace Division, Lindberg Engineering Co., and Kenneth D. Hoke, former vice-president of Fisher Furnace Co., will head this division.

A completely new Lindberg-Fisher induction melting furnace is the first development of the combined organization. Information about it will be released shortly.

Zeisel Promoted by Eutectic

Albert E. Zeisel ⊕ has recently been appointed vice-president in charge of sales of the Eutectic Welding Alloys Corp. Mr. Zeisel joined the corporation in 1944 and has worked as field engineer for Virginia and the District of Columbia, manager of the Midwest area, and assistant to the president in charge of sales.

NATIONAL MEETINGS
for June

June 1-6—Society of Automotive Engineers. Summer Meeting, French Lick Springs Hotel, French Lick, Ind. (John A. C. Warner, secretary, 29 West 39th St., New York 18.)

June 2-4—American Gear Manufacturers Association. Semi-annual meeting, Hot Springs, Va. (N. C. Goin, executive secretary, A.G.M.A., Empire Bldg., Pittsburgh 22.)

June 5-6—American Society for Quality Control. Annual Convention and Midwest Quality Control Conference, Hotel Sherman, Chicago. (Edward D. Thompson, general chairman, P. O. Box 1097, Chicago 90.)

June 16-19—American Society of Mechanical Engineers. Semi-annual meeting, Hotel Stevens, Chicago. (Ernest Hartford, executive assistant secretary, A.S.M.E., 29 West 39th St., New York 19.)

June 16-20—American Society for Testing Materials. 50th Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. (R. J. Painter, A.S.T.M., 1916 Race St., Philadelphia 3.)

June 21—American Physical Society. First meeting of Division of Solid State Physics, Montreal, Canada. (R. Smoluchowski, Carnegie Institute of Technology, Pittsburgh 13.)

June 23-27—American Electroplaters' Society. 1947 Annual Convention and Industrial Finishing Exposition, Convention Hall and Hotel Statler, Detroit. (Jesse E. Bunch, 4484 Cass Ave., Detroit 1.)

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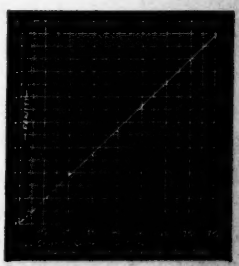

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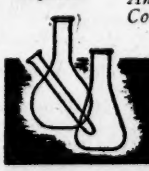

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22-175. A Satisfactory Technique for Vertical and Horizontal-Vertical Butt Welds in Plate Work. E. Fuchs. *Welder*, v. 15, Oct-Dec. 1946, p. 88-91.

A 90° double-V preparation is recommended as leading to high-quality, high-speed butt welds in the vertical and horizontal-vertical positions. For the latter the only special precaution required is to use a deep-penetrating electrode for the first run on the second side. For vertical seams a backstep method and two-operator working have solved the problem of overlap and virtually that of lack of centerline fusion.

22-176. All-Welded Gas Holder. *Welder*, v. 15, Oct-Dec. 1946, p. 98-103.

Construction, assembly and positioning, erection and final welding.

22-177. Pulling Harrow Teeth With a Spot Welder. *Steel*, v. 120, March 1947, p. 82-83.

Job done by resistance welding simply by having a high-amperage current flow through the bar and by pulling it apart at the proper moment so that it will stretch and break into two perfect points. Welder was equipped with two special hydraulic clamping devices, cylinders and flexible cables, and instead of using the cylinders for obtaining pressure at the tips, the operation was reversed.

22-178. Oxy-Acetylene Cutting in Sheet Metal Work. Part I. R. F. Helmkamp. *Sheet Metal Worker*, v. 38, March 1947, p. 46-49.

Fundamentals of the process and equipment used.

22-179. Production Applications for Inert Gas-Shielded Arc Welding. H. T. Herbst. *Light Metal Age*, v. 5, March 1947, p. 14-17, 21.

Applications of Heliarc welding for the light metals.

22-180. Hot Punching Railroad Tie Plates. *Fusion Facts*, v. 12, Feb. 1947, p. 5-6.

Use of hard facing alloys on the punches. Instead of becoming too dull for further use after 200 to 500 plates, the punches produced 27,500 plates without shutdown when faced with "Stoody 6" alloy.

22-181. A Novel Method of Rebuilding and Hard Facing Dredging Equipment. *Fusion Facts*, v. 12, Feb. 1947, p. 7-10.

Improved hard facing technique using "Stoody Self-Hardening" and "Stoody High Carbon" alloys to build up the leading edges of the impeller and "Stoody Tube Borium" for the core edges.

22-182. A Simple Jig for Hard Facing Shovel Track Pads. *Fusion Facts*, v. 12, Feb. 1947, p. 14-15.

Jig is described and illustrated.

22-183. Variations in Hard Facing Tire Chains. *Fusion Facts*, v. 12, Feb. 1947, p. 16-18.

How to use hard facing to increase life of tire chains by 3 to 7 times.

22-184. Trends in Automobile Assembly and Welding. Louis M. Benkert. *Steel Processing*, v. 33, March 1947, p. 162-163, 178.

Some general remarks on present-day assembly methods.

22-185. Submerged-Melt Welding in Pressure Vessel Fabrication. N. G. Schreiner. *Steel Processing*, v. 33, March 1947, p. 169-174, 180.

Advantages of process; principles of the process; preparation for welding; fabricating methods.

22-186. How Silver Brazing May Simplify Casting Design. S. D. Heron. *Steel*, v. 120, April 7, 1947, p. 90-91, 120, 122.

Experimental work on multipiece silver-brazed L-head cylinder blocks and other complicated castings indicates that an assembly can be as economical and efficient as one-piece casting.

22-187. This Company Fabricates and Enamels Washing-Machine Tubs. Dana Chase. *Finish*, v. 4, April 1947, p. 15-18, 56, 58.

Tub fabrication by welding and porcelain enameling in a box furnace plant.

22-188. Modern Electric Welding Equipment for the Cement Industry. Aubrey Smith and Walter J. Campbell. *Pit and Quarry*, v. 39, March 1947, p. 82-84, 86.

Applications to contruction and maintenance of equipment.

22-189. Hard Facing Welding in Concrete Products Plant Equipment Maintenance. Ralph Reiner and C. E. Ehle. *Pit and Quarry*, v. 39, March 1947, p. 152-154.

Techniques used.

22-190. Jigging for Better Welds. *Linde Tips*, v. 26, April 1947, p. 37-45.

Simple work-holding devices which make the job easier.

22-191. Fast Tooling for Tank Heads. *Linde Tips*, v. 26, April 1947, p. 46-47.

Forming press platen and die ring shaped by portable cutting machine equipped with a C-39 cutting blowpipe in only 12¾ hr., including layout and setup time. Fabricating costs, less stock and final machining, amounted to less than $70.00.

22-192. Reclamation Improves Performance. *Linde Tips*, v. 26, April 1947, p. 48-49.

An example whereby printing press clips rebuilt by bronze welding and bronze surfacing are better than new.

22-193. Work Supports for Machine-Cutting. *Linde Tips*, v. 26, April 1947, p. 53-54.

Design and dimensions of work supports for oxy-acetylene shape-cutting. They can be fabricated readily from standard steel shapes.

22-194. Oxy-Acetylene Pressure Welding. *Linde Tips*, v. 26, April 1947, p. 56.

How the process works and its advantages. Mechanical equipment required.

22-195. Handle Oxygen Cylinders With Care. *Linde Tips*, v. 26, April 1947, p. 58-60.

A few rules to eliminate carelessness and improper handling.

22-196. For Easier Control of Weld Metal. *Linde Tips*, v. 26, April 1947, p. 62-64.

Some uses in repair shop for welding carbon products.

22-197. Welding and Health. T. B. Jefferson. *Welding Engineer*, v. 32, April 1947, p. 47-51.

Are welders and flame-cutting operators subjected to unusual health hazards? Most of the dangers are imaginary, as shown by investigators who have made careful studies of the medical records of thousands of industrial plants during the war. In every instance records reveal that the general health of a welder was no worse than that of other workers.

22-198. Who Makes It? The Welding Engineer's 1947 Directory. *Welding Engineer*, v. 32, April 1947, p. 61-84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116.

Manufacturers and selected distributors of welding equipment and supplies are listed alphabetically under 325 classifications.

22-199. Some Fundamental Principles for the Resistance Welding of Sheet Metal. H. E. Dixon. *Sheet Metal Industries*, v. 24, March 1947, p. 607-612.

The various factors affecting pressure welding and some fundamental aspects of resistance welding.

22-200. The Welding of Nonferrous Metals. Part VIII. (Continued.) E. G. West. *Sheet Metal Industries*, v. 24, March 1947, p. 618-622, 624.

The welding of copper and its alloys. (To be continued.)

22-201. Welded Carriage Construction. *Welding*, v. 15, March 1947, p. 98-107.

The procedures adopted for the production of welded mainline coaches. Their design provides a striking example of how the application of welding can reduce weight and at the same time increase strength.

22-202. Resistance Welding in Mass Production. A. J. Hipperson and T. Watson. *Welding*, v. 15, March 1947, p. 117-124.

The application of the various resistance processes from the point of view of the production engineer. Various types of spot welding equipment, the services required, and maintenance.

22-203. Strength and Safety of Welded Joints. M. Ros. *Welding*, v. 15, March 1947, p. 125-131.

Based on results and conclusions from 12-yr. tests in Switzerland. (Abstracted from *Schweizer Archiv*, no. 1, 2, 3, 1946.)

22-204. Arc Welding Electrode Holder. *Engineering*, v. 163, March 14, 1947, p. 201.

British-made electrode holder is completely insulated and wholly enclosed.

22-205. Certain Aspects of Seam Welds in Aluminum Alloy Sheets. Gerard H. Boss. *Metal Progress*, v. 51, April 1947, p. 599-602.

Essential difference between seam welds and spot welds is that the overlapping spots comprising the seam short-circuit a considerable part of the welding current, thus postheating the slugs. This extra heat has definite metallurgical action in relieving internal stress and even permitting the diffusion of elements segregated during the welding cycle proper. Radiographs of welded aluminum alloy sheet; use of radiography and tensile testing in determining the quality of seam-welded joints.

22-206. Riveting Disadvantages Overcome by Machines. William P. Brotherton. *Production Engineering & Management*, v. 19, April 1947, p. 56-60.

Various types of rivets and some examples of machine riveting.

22-207. Spot Welding of Assemblies. Floyd Matthews. *Aero Digest*, v. 54, April 1947, p. 82.

Procedures at Boeing Aircraft.

22-208. Position Control in Welding. Arthur M. Unger. *Electronic Industries & Electronic Instrumentation*, v. 1, April 1947, p. 3.

Multiple-electrode welder with an electronically controlled indexing mechanism for welding stiffeners to sheet steel for box-car sides. Welding takes place whenever a beam of light passes through a hole and strikes a phototube.

22-209. High Lights and Side Lights. *General Electric Review*, v. 50, April 1947, p. 56-57.

How automatic arc welding is used to build up worn locomotive-wheel centers.

22-210. Foundry and Steel Mill Oxy-Acetylene Cutting. R. S. Babcock. *Industry and Welding*, v. 20, April 1947, p. 26-29, 64-65.

Development of improved equipment for cutting normal thicknesses of steel and design of machine-borne cutting apparatus for severing thicker sections than have ever been cut before.

22-211. Are You Fabricating Correctly? G. E. Campbell. *Industry and Welding*, v. 20, April 1947, p. 30-32, 65-66.

The important subjects of electrode selection, design of fixtures, welding positioners, equipment and personnel.

22-212. What Is Proper Welding Control? Part I. G. W. Garman. *Industry and Welding*, v. 20, April 1947, p. 34-36.

Why resistance welding control is needed and how proper control equipment fills this need. Requirements for each type of resistance welding. (To be continued.)

22-213. Why, When, Where, How to Use the Carbon Arc With A. C. Transformers.

(Turn to page 46)

Metal Hydrides Are Source of Improved Alloys

Reported by A. R. Feinburg
Missouri School of Mines and Metallurgy

"Metal Hydrides" was the subject presented before the Missouri School of Mines Chapter ⊜ on Feb. 26 by Daniel S. Eppelsheimer. Dr. Eppelsheimer, who was recently appointed associate professor of metallurgical engineering at Missouri School of Mines and Metallurgy, was formerly chief physical metallurgist and sales manager of Metal Hydrides, Inc.

Dr. Eppelsheimer explained the method of manufacture and some of the problems in the commercial production of titanium, zirconium, thorium, calcium and their hydrides. Practical applications of the hydrides include the use of calcium hydride as a reducing agent in the preparation of rare metals and as a source of hydrogen for portable emergency hydrogen generators.

An alloy of 99% magnesium and 1% zirconium which has a tensile strength of 70,000 to 75,000 psi. can be made from the master alloy of 50% Mg and 50% Zr. Other alloys of rare metals are created from TiH_2, ZrH_2 and ThH_4. Titanium hydride is also utilized in a hard facing process called titanizing.

The lecturer displayed crystals of 50% zirconium and 50% lead, a pyrophoric alloy. This alloy formed part of a series in which titanium replaced zirconium, and tin replaced lead in varying proportions with accompanying variation in sparking characteristics. The metallurgist concluded that an alloy of less than 25% Zr, or its replacement, is not pyrophoric.

As a practical test, one of these alloys was substituted for the flint in a cigarette lighter. After nearly one year only slight wear could be detected.

Tatnall at Joint Meeting Of Two Rochester Groups

Reported by R. C. Hendrickson
Metallurgist
Bausch and Lomb Optical Co.

The Rochester Chapter ⊜ and the Superintendents' and Production Managers' Group of Rochester met together last month for the annual joint meeting of the two organizations. F. G. Tatnall, director of testing research of the Baldwin Locomotive Works, presented a rapid-fire address on physical testing and engineering which held the attention of both groups through a very instructive evening. Mr. Tatnall emphasized the need for fitting test procedures to the service requirements of materials and showed how strain gages have been used to detect unbalanced stresses in loaded sections.

Naujoks Elected President Of Bison Forge in Buffalo

Waldemar Naujoks has been elected president of the Bison Forge Co., Inc., Buffalo, N. Y., where he is associated as a partner. Mr. Naujoks, a past chairman of the Cleveland Chapter ⊜, is noted as an authority on forging practice, and is the author of the monumental "Forging Handbook" published by the A.S.M.

W. Naujoks

Mr. Naujoks was formerly chief engineer of The Steel Improvement & Forge Co., Cleveland. He is a graduate of the University of Wisconsin with degrees of M.E. and B.S. in Mechanical Engineering.

Rimbach Opens New Business

A new business, Triometric, Inc., Pittsburgh 12, Pa., has been started by Richard Rimbach ⊜ for the production of three-dimensional precision scale models and templates which are used as a guide in setting up and rearranging the layout of industrial plants, warehouses and offices.

The company also offers a consulting service in plant design.

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William P. Good. *Industry and Welding*, v. 20, April 1947, p. 40-42, 44, 68-70, 72.

Four basic elements or conditions to properly evaluate this method of applying heat are: amount of metal to be heated and degree of heat required; type of joint to be made; kind of metal involved; and suitability of the Arc Torch method.

22-214. Depositing Overlaid Surfaces by the Submerged-Melt Welding Process. L. C. Bradburn, J. M. Keir and J. E. Taylerson. *Welding Journal*, v. 26, April 1947, p. 297-300.

Techniques for Unionmelt surfacing in the manufacturing of articles composed of dissimilar materials. For example, cast-steel valves can be surfaced with stainless materials which exhibit better wear and corrosion qualities than those normally obtained from cast steel.

22-215. Oxygen Cutting of Steel at Elevated Temperatures. J. F. Kiernan and J. S. Sohn. *Welding Journal*, v. 26, April 1947, p. 301-313.

Results of over 3000 controlled-cutting tests at rolling mill temperatures (1700 to 2000° F.) are correlated and presented in order to supply information not previously published concerning fundamental standards and relationships.

22-216. Ryan Welding Innovations. William P. Brotherton. *Welding Journal*, v. 26, April 1947, p. 323-326.

New techniques developed at Ryan Aeronautical Co. for welding of stainless. These include: a new type of oxy-acetylene welding torch with two tips, for simultaneous trimming of flange metal and seam welding in production of exhaust systems; a three-tip torch with two natural gas tips for preheating and postheating of stainless steel welds and an oxy-acetylene tip for welding; tacking pliers and adjustable clamp for spot welding; device for automatic atomic-hydrogen welding of tubular stainless-steel sections; and several other useful production devices.

22-217. Jigs and Fixtures for Automatic Fusion Welding. E. D. Morris and L. J. Berkeley. *Welding Journal*, v. 26, April 1947, p. 332-337.

Illustrated article describes a variety of these arrangements.

22-218. Submerged Melt Welding of Corrosion Resistant Metals. R. J. Anderson and H. J. Roberts. *Welding Journal*, v. 26, April 1947, p. 338-342.

Some of the problems and reports on some of the methods that have been developed for producing satisfactory welds in this class of material. The welding of some heat resistant metals.

22-219. An Investigation of the Influence of Hydrogen on the Ductility of Arc Welds in Mild Steel. Alan E. Flanigan. *Welding Journal*, v. 26, April 1947, p. 193s-214s.

An effort was made to correlate the ductility of E6010 mild steel welds with hydrogen content of weld metal. Ductility was evaluated by means of a notched-bend test at —40° F. Hydrogen analyses were made by a vacuum-extraction method. Specimens were subjected to a variety of treatments including postheating, preheating, and rapid cooling following welding. Low-hydrogen welds were prepared with lime-base coated electrodes and by the submerged-arc process for comparison purposes. To obtain further information, hydrogen-free welds were charged with hydrogen by means of acid pickling. An extensive study of postheating at temperatures from 250 to 1150° F. was made to determine its effects on weld hardness and residual stress, and upon hydrogen content and ductility. 50 ref.

22-220. Fatigue Tests on Some Spot Welded Joints in Aluminum Alloy Sheet Materials. H. J. Grover and L. R. Jackson. *Welding Journal*, v. 26, April 1947, p. 218s-232s.

The major results of an extensive fatigue-testing program conducted at Battelle Memorial Institute under the sponsorship of N.A.C.A. Three simple structural elements were tested: spot welded stiffened panels, sheets with spot welded attachments, and spot welded lap joints. Among the variables examined were: sheet thickness, spot weld spacing, and, to a lesser extent, sheet material and welding procedure. Contains a large number of tables, charts, photographs, and photomicrographs. 10 ref.

22-221. Summary of Results of Tests Made by Aluminum Research Laboratories of Spot Welded Joints and Structural Elements. E. C. Hartmann and G. W. Stickley. *Welding Journal*, v. 26, April 1947, p. 233s-251s.

Available information concerning spot welding as a means of joining aluminum alloy parts and comparisons of the relative merits of spot welded and riveted aluminum alloy structural elements. (Reprinted from Technical Note No. 869, National Advisory Committee for Aeronautics, Washington, Nov. 1942.)

22-222. New Flux-Cored Filler Rods for Torch Welding. F. Danhier. *Welding Journal*, v. 26, April 1947, p. 252s-253s.

Several new rods and the method for their fabrication. Why rods with the flux distributed throughout the interior of the rod are superior to coated rods. (Abstracted from *Arcos*, no. 102, 1946, p. 2430-2433.)

22-223. A Welding Quest. William L. Warner. *Welding Journal*, v. 26, April 1947, p. 253s-256s.

Developing a suitable simple test method for the evaluation of quantitative weldability of base metal. The various methods which have been proposed and used are considered critically, and their limitations pointed out. Concludes that any method for determining the welding characteristics of metals, particularly high-strength steels, should include both a crack-susceptibility test and a welded-joint toughness test. Possible value of obtaining a correlation between ductility and toughness at various strength levels.

22-224. Radial Head Positioner Speeds Welding Operations. *Iron Age*, v. 159, April 10, 1947, p. 84.

New type of fixture is composed of an automatic shielded-arc welding head, traveling on a beam that encompasses a vertical zone of 8 ft., with the assembly rotating around a fixed axis to a maximum radius of 20 ft. It is designed to augment the efficiency of automatic arc welding and speed up the process.

22-225. Causes and Prevention of Welding Defects. Frederick S. Dever. *Iron Age*, v. 159, April 17, 1947, p. 50-53.

The most frequently occurring defects and the causes and methods of eliminating them.

22-226. Mechanized Soft Soldering. *Steel*, v. 120, April 14, 1947, p. 98, 123.

Production of air-conditioning units speeded by moving work at predetermined speed under fluxing brush, oxy-acetylene flame and a solder feed.

For additional annotations indexed in other sections, see:

3-110; 4-39; 7-107-125; 9-40-41; 12-62; 18-78; 23-110-116-117-122-124; 24-93-94-103-105-109-111-113-117-118; 27-79-81.

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23 INDUSTRIAL USES and Applications

23-91. Stainless Steel Bids for Body Work. *SAE Journal*, v. 55, March 1947, p. 24-26.

Advantages, disadvantages, and design factors at Fruehauf Trailer Co. (Excerpts from paper "Motor Haulage Bodies of Stainless Steel", by V. M. Drew.)

23-92. 30-Inch Pipeline. *Steel*, v. 120, March 24, 1947, p. 74-75, 110.

Techniques used in fabrication of manganese steel pipe for a 214-mile high-pressure gas line.

23-93. Present Trends in Alloys. *Canadian Metals & Metallurgical Industries*, v. 10, March 1947, p. 25-26.

Alloy steels; stainless steels; high-temperature alloys; alloy cast irons; cast bronzes; high-nickel irons; nickel plating; and nickel and high-nickel alloys.

23-94. Aluminum Nail Seen New Factor in Special Purpose Field. T. E. Lloyd. *Iron Age*, v. 159, March 27, 1947, p. 102-103.

Development, and some applications. Present manufacturers.

23-95. The Martin Outboard Motor. G. E. Buske. *Modern Metals*, v. 3, March 1947, p. 15-17.

Designed to take full advantage of various properties and manufacturing processes for aluminum.

23-96. Aluminum Windows. *Modern Metals*, v. 3, March 1947, p. 18-19.

Progress in manufacture of aluminum windows. Advantages of producing knocked-down assemblies from an ultimate cost-saving standpoint, as well as building a plant near a source of raw materials.

23-97. Building the "Martin 60". Howard Campbell. *Modern Machine Shop*, v. 19, April 1947, p. 124-130, 132, 134.

The manufacturing operation in the building of the "Martin 60" streamlined outboard motor. Special adaptations of the standard equipment and numerous jigs and fixtures are used in the machining of more than 21 aluminum die castings as well as the fabricating of many aluminum stampings.

23-98. Architecture Awakens to the Value of Light Metals. G. H. Friese-Greene. *Light Metal Age*, v. 5, March 1947, p. 8-13, 33-34.

Applications of the light metals in decorative and practical aspects of architecture.

23-99. Progress in Light Metals. W. C. Devereux. *Light Metal Age*, v. 5, March 1947, p. 23, 33.

Progress made in application of aluminum in England.

23-100. The Controlling Factor. *Die Castings*, v. 5, April 1947, p. 19-21, 36.

Accuracy and durability have been gained by die casting a valve operator and a timing device.

23-101. Die Castings in Automotive Hydraulics. John B. Parsons. *Die Castings*, v. 5, April 1947, p. 24-26, 37-40.

Dura Co. has combined aluminum and zinc alloy die castings, along with powdered metal parts and drawn forms, to turn out a low price hydraulic system which meets cost and service specifications.

23-102. Designed for Strength. *Die Castings*, v. 5, April 1947, p. 32-34.

A photographic enlarger in which a dozen zinc alloy die castings are advantageously employed.

23-103. Magnesium in Army Ordnance. C. H. Corey. *Army Ordnance*, v. 31, March-April 1947, p. 418-419.

Applications of magnesium in the above field.

(Turn to page 48)

Testing and Inspection

(Continued from page 8)

caliber bullet cores were sorted for compliance with hardness specifications. This was done in a special adapter at a rate of 250 to 300 cores per min.

The instrument must be adapted to the specific job at hand. It is suited to process control, especially for checking on heat treating.

Supersonic Testing

The Sperry supersonic Reflectoscope and Thruray and the Brush Hypersonic analyzer have found some industrial application in this country. The Reflectoscope is used to detect laminations and small cracks. Chief limitations are the inability to test very close to the surface or to inspect thin pieces. Steels can be tested in thicknesses of 10 ft. or more (12-27, March 1946; 12-202, January 1947).

The Hypersonic analyzer has been used industrially to detect separations or pipes in thin plate, sheet, and strip (12-15, February 1946; 12-23, March 1946). Much work remains to be done in correlating data obtained by supersonic inspection methods with physical tests and performance in service.

Desch and his associates have thoroughly investigated the use of supersonic waves for the detection of cracks in steel (12-84, June 1946; 12-21, February 1947). The apparatus employs piezoelectric quartz transmitters for sending out intermittent pulses of supersonic waves and receiving them also on quartz crystals after reflection, the reflected waves being electrically amplified and indicated on a cathode-ray oscilloscope. Because of the high degree of sensitivity of this type of instrument, the final result may be "an erroneous interpretation of unavoidable trivial irregularities, the presence of which is in no way detrimental to the service of the article in question".

Quality in actual service is what really counts. Foundrymen have found that the properties of a test ingot will reveal the quality of the metal poured without giving any information on the soundness of a casting poured from the same heat. Conventional tests are quite definite in separating those materials that might have a chance from those that are impossible. Cost of the finished product must always be kept in mind.

If service requirements and all needed properties could be specified in quantitative terms, the selection of materials would be a cinch; using tabulated data, almost anyone could readily make the right selection. Uncertainty as to actual service requirements and nonuniformity between ostensibly identical batches of metal add to the complexity of the problem and make it highly desirable to base selections on the sound engineering judgment and practical experience of the design and materials engineers.

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METALS REVIEW

7301 EUCLID AVENUE • CLEVELAND 3, OHIO

23-104. Steel for Tomorrow's Oil. H. M. Cooley. *Drilling Contractor*, v. 3, Feb. 15, 1947, p. 39-41.

The metallurgical problems involved in drilling for oil at depths of 20,000 ft.

23-105. Woven Wire Conveyer Belts for High-Temperature Service. Fred L. Hooper. *Steel Processing*, v. 33, March 1947, p. 157-161.

How to select such belts as to alloy type and structural design. Their application to miscellaneous metallurgical mass-production operations.

23-106. The Electrolytic Valve Action of Zirconium. Walter R. Carmody. *Electrochemical Society Preprint 91-9*, 1947, 9 p.

Tests of rectifying properties show that zirconium is a suitable electrode material for an electrolytic rectifier when used with sulphuric acid as the electrolyte. Its behavior is practically identical with that of tantalum, with the exception that its breakdown voltage is somewhat lower. The current capacity of the zirconium electrolytic rectifier is limited by the rate at which it can dissipate the heat generated within the rectifier.

23-107. Over the Horizon in the Rotel. H. L. Yoh. *Steel Horizons*, v. 9, no. 2, 1947, p. 5-7.

Design of prefabricated tourist cottages constructed from panels of either 1½-in. insulation board covered with light-gage stainless steel or stainless bonded to plywood.

23-108. Industrial Electronic Equipment Uses. Part I. W. C. White. *Electronic Industries & Electronic Instrumentation*, v. 1, March 1947, p. 6-7.

A classified bibliography of English-language references to applications of electronics in industry. 154 ref.

23-109. Rigidized Metal Offers New Design Possibilities. *Iron Age*, v. 159, April 3, 1947, p. 63.

Various applications of rigidized metal, along with samples of the typical patterns available. Patterns are all rolled into the sheets by means of especially designed rolls used in a conventional type two-high mill.

23-110. Radiant Heating—Expanding Market for Welding. J. J. Welch. *Welding Engineer*, v. 32, April 1947, p. 52-55.

How radiant heating works and how installations are made.

23-111. Manganese Steel Used on a Slag Dump. *Edgar Allen News*, v. 25, March 1947, p. 780-781.

Use of manganese steel for excavating, screening, elevating, conveying, separating, preparation, and transporting units used in the recovery of steel scrap from openhearth and bessemer slag.

23-112. The Production of Muir Gear Hobbers. *Machinery (London)*, v. 70, March 6, 1947, p. 232-238.

Improved layout and methods in the reorganized factory.

23-113. Applications of Woven Wire Conveyer Belts. Part II. Fred L. Hooper. *Industrial Heating*, v. 14, April 1947, p. 586-588, 590, 592, 594, 688.

Types of weaves employed for different services, and the numerous ways in which belts can be installed are given consideration in generalized classes.

23-114. Aluminum for Duct Work. H. F. Johnson. *Heating and Ventilating*, v. 44, April 1947, p. 95-96.

Use of aluminum for heating and ventilating duct work in industrial and domestic installations.

23-115. Carbide Cutters Outlast Steel. *American Pressman*, v. 57, April 1947, p. 38-39.

Detroit News reports total elimination of tool replacement, and almost total elimination of knife sharpening on its Hoe Monorail Stereotype Trimmers, by installation of Carboloy cemented-carbide-tipped knives in place of conventional steel knives.

23-116. Development of Jacketed-Type Steel Drier Rolls. William H. Funk. *Welding Journal*, v. 26, April 1947, p. 314-319.

A number of these rolls designed for use in diverse industries, such as paper making, printing, textile, film processing, plastics, rubber and chemical. General and specific information concerning design.

23-117. Sheet Metal Assembly Improved by Resistance Welding *Welding Journal*, v. 26, April 1947, p. 356, 358.

How sheet-metal display signs are fabricated by resistance welding instead of by bolting and riveting.

23-118. First All-Aluminum Ships Are Planned. *Aluminum Bulletin*, v. 1, March 1947, p. 3.

Two bauxite-carriers soon to be constructed for Alcoa Steamship Co. Results of an eleven-year study of an all-aluminum hull moored at Newport News, Va., led to the decision to build the ships. Paint systems used.

23-119. Aluminum Becoming Increasingly Popular for Packaging. *Aluminum Bulletin*, v. 1, March 1947, p. 4-5.

Some of these uses are illustrated and described.

23-120. Metal-Ceramic Combinations. Louis R. McCreight. *Ceramic Industry*, v. 48, April 1947, p. 110.

Miscellaneous applications.

23-121. One-Piece Bearings Mounted in Steel Shells Solve Crusher Bearing Troubles. Nelson Severinghaus. *Pit and Quarry*, v. 39, April 1947, p. 76.

How Ryertex bearings mounted in solid steel shells overcame trouble with 60x48-in. rock crusher. This crusher was originally fitted with gray-iron half-shell bearings.

23-122. Use Blind Rivets for Locations of Difficult Accessibility. *Electrical Manufacturing*, v. 39, April 1947, p. 93-97, 174, 176, 178, 180.

Numerous applications are illustrated and described.

23-123. Steel Forms Speed Construction of Long Bridge Approach. *Engineering News-Record*, v. 138, April 3, 1947, p. 91-93.

Use of steel forms for the piles, caps, and deck.

23-124. The Milwaukee's 40-Ft. 6-In., 50-Ton, Welded Box Cars. *Railway Age*, v. 122, April 5, 1947, p. 703-704.

Construction details.

For additional annotations indexed in other sections, see:
3-100; 13-17; 19-103-109-112; 20-169-184-191-195; 22-187; 24-99-112; 27-73.

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24 DESIGN

24-92. The Case for Axonometric Drawing. Paul F. Boehm. *Steel*, v. 120, March 24, 1947, p. 80-81, 103.

Compares simplicity of one-view engineering drawings to conventional multiplanar, or three-view drawings.

24-93. The Evolution of Diesel Engine Block Weldment Design and Fabrication. James W. Owens. *Welding Journal*, v. 26, March 1947, p. 240-247.

The various designs and reasons for changes made. A number of revisions to the American Welding Society's definitions of terms used in structural welding and inspection, which were found necessary on account of improvements in inspecting methods.

24-94. Discussion of the Paper "Redistribution of Residual Welding Stresses by Tensile Loading Along a Unionmelt Weld Joining Two 3-Ft. x 12-Ft. x 1-In. Plates". *Welding Journal*, v. 26, March 1947, p. 138s, 191s-192s.

E. M. MacCutcheon and J. Vasta discuss separately a paper by Meriam, DeGarmo, and Jonassen, published in Oct. 1946 issue. Both discuss the problem of applying the laboratory results to welded ship structures. Mr. Vasta gives some strain gage results from tests on a Liberty ship. Authors' reply.

24-95. Forging Die Design. John Mueller. *Steel Processing*, v. 33, March 1947, p. 164, 166.

Die typing.

24-96. Principles of Design for Carbides and Some Unusual Applications. *Iron Age*, v. 159, March 27, 1947, p. 56-57.

The development of carbides. A great increase in their utilization has occurred since 1939 because of the introduction of materials containing tantalum, titanium, and columbium carbides. Design principles and the three principal techniques used to form carbide shapes.

24-97. How to Cut Costs of Plastic Molds. Harold L. Flynn. *American Machinist*, v. 91, March 27, 1947, p. 93-100.

Development of a method of casting stainless-steel cavities; forces, and inserts. Patternmaking methods and design for cast cavities.

24-98. Designing of "Trouble-Free" Dies. Part LXVII. C. W. Hinman. *Modern Industrial "Press"*, v. 9, March 1947, p. 22.

Assembling dies.

24-99. Hardware Design. H. K. Barton. *Die Castings*, v. 5, April 1947, p. 22, 41, 43.

Suggests some methods for designing knobs, handles, and other small hardware parts of approximately spherical or ellipsoidal shape.

24-100. Engineering Aspects of the Involute Spline. H. E. Linsley. *Iron Age*, v. 159, April 3, 1947, p. 64-68.

Involute spline offers many advantages over the old-style straight-side spline, both as regards structural strength and simplicity of tooling. Engineering and manufacturing aspects compiled through the cooperation of the Broaching Tool Institute, Detroit, and mathematical formulas for calculating the torque capacity of splined fittings.

24-101. Casting Design. Richard A. Flinn. *Foundry*, v. 75, April 1947, p. 106-109, 267-268, 270.

Experimental stress analysis and its application in the foundry field in order to further cooperation between casting designer and foundryman.

24-102. Formulas for Determining the Weights of Castings. (Continued.) *Foundry*, v. 75, April 1947, p. 175-176.

Formulas and tables for segments of rings of elliptical cross section; segments of solids generated by revolving a plane area about an axis; inside and outside circular fillets and their sectors. (To be concluded.)

24-103. Stresses and Deflections of Two Cargo Liners During Launching. K. J. Pascoe. *Transactions of the Institution of Engineers & Shipbuilders in Scotland*, v. 90, Dec. 1946, p. 126; discussion, p. 157-168; Jan. 1947, p. 169-171.

Investigations were made during launching of two similar ships, one of which was partly welded and the other of riveted construction. The primary object was to measure the longitudinal strains and the deflections imposed on the ship's structure during launching and to relate these to the position of the ship on the ways. No conclusive evidence of any difference in structural behavior between the two forms of construction was revealed. Curves of both experimental and calculated values of stress and deflection are included.

(Turn to page 50)

Grinding Cracks And Burn Detected By Macro-Inspection

Reported by Stephen M. Jablonski
Metallurgist, Wyman-Gordon Co.

"Cracks and Burn in Ground Surfaces" may be detected by macro-inspection and etching methods, according to Leo P. Tarasov, research laboratory metallurgist, Norton Co. Dr. Tarasov addressed a joint meeting of the Worcester Chapter with the Worcester Engineering Society.

Grinding cracks generally appear across the grinding marks, he pointed out, and where grinding is severe, secondary cracks may develop, branching off the original cracks.

Nitric acid should always be used for etching, the speaker cautioned, since hydrochloric or sulphuric acid will embrittle the steel and show up stress cracks. A two-stage etchant is used to detect burn in steel, he said; first a 12-sec. etch in 4% nitric acid in water, and then a 15-sec. etch in 2% hydrochloric acid in acetone. Burn is detected as either tempered or rehardened metal, depending upon the severity of burn.

Care should be exercised in analysis of defects, for they may be caused by improper heat treatment, which leaves the steel in a brittle condition, and thus very susceptible to cracking, even though grinding practice is satisfactory. Cracks may result either from improper grinding or improper heat treatment, or sometimes a combination of both. However, by proper selection of wheels and grinding technique, it is possible to grind steel in a brittle state and avoid cracks.

Dr. Tarasov gave a few illustrated case histories of grinding cracks and burn. In conclusion, he said, there are so many variables that no general rule can be applied to find the source of the trouble, or to obtain the most economical solution. The most important thing is to know how to look for the various factors that may be involved in cracking and burn.

Boegehold Initiated as Texan

The Final Round-Up. President Boegehold (second from left) has shed his coat, donned his Texas hat and, with his branding iron in hand, puts his brand on the calfskin of the Texas Chapter. Left to right are Past Chairman W. E. Burndrett, National President Boegehold, Chapter Chairman G. R. Ingels, and Vice-Chairman K. P. Campbell

Reported by M. W. Williams
Foundry Manager, Hughes Tool Co.

Texas Chapter's annual Western Night, with all members dressed in boots, spurs and ten-gallon hats, was a rip-roaring success on March 17. National President A. L. Boegehold, after barely escaping with his life for cattle rustling, presented a medal of honor for R. W. Schlumpf, chief metallurgist of Hughes Tool Co. This medal is in commendation of the service and time Mr. Schlumpf has devoted to A.S.M. activities. In the absence of Mr. Schlumpf, the medal was accepted by Glenn R. Ingels, chapter chairman.

Mr. Boegehold then discussed the hardenability properties which may be expected from steels purchased under S.A.E. chemical specifications and H-bands. He pointed out that more and more buyers are specifying hardenability bands, and indicated the problems which occur in producing steels to meet hardenability specifications.

As a final initiation into the Texas Chapter, Mr. Boegehold was presented with a ten-gallon hat and his own branding iron.

Seger Explains Heat Treatment For Plastic Molds

Reported by H. L. Millar
Metallurgist, Plomb Tool Co.

Speaking before the first joint meeting of the Los Angeles Chapter and the Pacific Section of the Society of Plastic Industries on "The Metallurgy and Heat Treatment of Plastic Molds", R. B. Seger, works manager of Lindberg Steel Treating Co., Chicago, pointed out that optimum results in plastic mold manufacturing can be obtained only through the combined efforts of the metallurgist, the mold maker and the heat treater.

The pressure and material used in molding, the abuse in use of molds by unskilled labor and the suitability to heat treatment were cited as important factors in the choice of steels for molds. Even more important is the ease with which these molds can be repaired, the speaker emphasized.

In view of the fact that deep hardening steels are more susceptible to breakage in service, Mr. Seger explained that carburizing steels of the chromium-nickel and chromium-molybdenum grades are more popular for plastic molds. When carburized to depths of 1/16 to 3/32 in. and heat treated to hardnesses of Rockwell C-54 to 60 for case and C-35 to 40 for core (according to the intricacy of the design), these molds should work efficiently at the extremely high pressures used in compression molding without premature failure. These steels also lend themselves satisfactorily to repair by welding when damaged or worn by abrasion of the molding material.

The function of the heat treater in the production of perfect plastic molds was outlined in interesting detail by the speaker, who dubbed himself a down-to-earth heat treater. It is the responsibility of the heat treating department to guard the shining perfection of the mold received from the mold maker with meticulous care to prevent damage and pitting in the mold cavity from water vapor, sulphur fumes or salt dust. Annealing between hobbing operations or incident to repair should produce the ultimate in softness with a minimum of scale and carburizing effect. Annealing scale is removed from the mold cavities by liquid honing, which consists of flushing the depressions with a water suspension of fine silica (350 to 1200 mesh) in a stream of air.

Of no little importance in this specialized technique of plastic mold heat treating, Mr. Seger explained, is the control of heat treating operations to produce a maximum uniform hardness over the surface of the mold cavities, with minimum scaling and distortion and freedom from cracking. Complicated jigs and flush quenching are used extensively to prevent air pockets in mold cavities.

24-104. The Stresses in Cylindrical Vessels. H. D. Conway. *Aircraft Engineering*, v. 19, Feb. 1947, p. 52-54.

Expressions for maximum bending moment and shearing force in vessels closed at one end and subjected internally to gas pressure and hydrostatic pressure. Since the expressions are very cumbersome, graphs are given whereby maximum bending moment and shearing force can be found for any cylindrical vessel subjected to gas or hydrostatic pressure.

24-105. Investigations of 24S-T Riveted Tension Joints. R. L. Fefferman and H. Langhaar. *Journal of the Aeronautical Sciences*, v. 14, March 1947, p. 133-147.

Test data for approximately 110 tension joints formed by uniting 24S-T sheets with protruding-head rivets. With the aid of an empirical "stress-concentration" factor, the data are correlated with a modified form of the theory of tension joints. An algebraic formulation of the elementary theory. Rules for laying out efficient joints.

24-106. Beam-Columns. Wm. R. Osgood. *Journal of the Aeronautical Sciences*, v. 14, March 1947, p. 167-170.

An improved method of designing beam-columns which appears to be both safe and economical.

24-107. Drawing Die Problems and Formulas. James Walker. *Tool Engineer*, v. 18, April 1947, p. 40-42.

Advanced design and construction of simple and compound drawing dies for the mass production industry.

24-108. Designing Tools for Screw Machine Production. Part VIII. *Screw Machine Engineering*, v. 8, April 1947, p. 46-48.

End working tools.

24-109. Poor Design May Stymie Shop Savings. Chester S. Ricker. *American Machinist*, v. 91, April 10, 1947, p. 140b-140c.

Resistance welded designs illustrate that cooperation between designers, process engineers, and production men can cut costs.

24-110. Graphical Method of Determining Size of Round Blanks. G. A. Larri. *Machinery*, v. 53, April 1947, p. 147-148.

A means of determining the diameter of a blank for a round drawn shell where the contour of the drawn shell is such as to make mathematical calculation of the blank diameter somewhat difficult. Method is applicable in cases where the thickness of the blank remains constant and also in cases where a variation in thickness occurs during the drawing operation.

24-111. Some Design Aspects of Hopper-Car Construction. W. B. Brooks. *Railway Mechanical Engineer*, v. 121, April 1947, p. 157-158.

Effects of stresses and drainage on the corrosion and cracking of steel plates and the value of welding in eliminating them.

24-112. Torsion-Bar Valve-Springs of Unusual Design Used in French Engine. W. F. Bradley. *Automotive and Aviation Industries*, v. 96, April 1, 1947, p. 24-26.

Patented feature of the torsion-bar valve-spring system is the use of torsion bars in pairs, thus reducing the length of the installation and eliminating the problem of housing longer bars. Valves are mounted vertically in the cylinder head, and are operated in the usual manner by push-rods and rockers. Metal used for the bars is chromium-nickel steel.

24-113. Design for Resistance Welding. Harold S. Card. *Electrical Manufacturing*, v. 39, April 1947, p. 98-102, 182, 184, 186.

Design factors that are of fundamental importance in obtaining the desired economy of production consistent with optimum weld strength for each of the resistance welding processes.

24-114. Designing Form Tools to Eliminate Production Loss. Harold P. Berry. *Production Engineering & Management*, v. 19, April 1947, p. 61-64.

Elements of design in form tools for bar stock used in automatic screw machines to reduce machine downtime resulting from the trial and error system of tooling.

24-115. Production Processes. Their Influence on Design. Roger W. Bolz. *Machine Design*, v. 19, April 1947, p. 169-174.

Design factors for production milling.

24-116. Metallurgy, Engineering and Specs. *SAE Journal*, v. 55, April 1947, p. 55-57.

The differences often encountered between experimental stress figures and those arrived at by conventional design formulas. Five reasons for making structures stronger while also making them lighter; and the steps usually followed in design improvement. (Excerpt from "Is There a Relationship Between Metallurgy, Engineering and Materials Specifications", by Francis G. Tatnall.)

24-117. The Welding of Stainless Steel for Jet Propulsion. E. J. DeWitt and F. J. Lammers. *Welding Journal*, v. 26, April 1947, p. 320-323.

Evolution in the design of a bellows for support of jet turbine-nozzle blading in its frame. The original design called for five welds and 50 ft. of welding on a 3-ft. diameter, $\frac{1}{8}$-in. piece, weighing only 90 lb. This required highly skilled welders, so the unit had to be redesigned so that it could be welded by women who had received only a short course in welding. Several steps took place before a final design was evolved which required much less welding and also much less skill on the part of the operators.

24-118. H-Section Welded Trusses. A. T. Waidelich. *Welding Journal*, v. 26, April 1947, p. 327-331.

The development of the above standard sections by the Austin Co. The term "H-section truss" refers to a truss in which all members are conventional rolled H or I sections with the webs of all members lying in the same vertical plane, and with all connections made at abutting surfaces of these H and I sections by fillet welds. The development consisted of analysis and design of the truss and an extensive program of testing, including loading two 50-ft. trusses to failure and a strain gage test of two 80-ft. trusses.

For additional annotations indexed in other sections, see:
19-96; 20-200; 22-201; 23-91-102-109-116.

NEW ENGLAND CARBIDE TOOL CO., INC.
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25 MISCELLANEOUS

25-46. Wartime Advances in Nonferrous Metallurgy in Britain. Basil J. S. Bard. *Metal Progress*, v. 51, March 1947, p. 411-413, 460.

The development of new alloys, improved processes, and drastic reduction of the time lapse between research discovery and practical application.

25-47. Automatic Handling Aids Plating Success. M. E. Kilroy. *American Machinist*, v. 91, March 27, 1947, p. 84-87.

An account of equipment and procedures at Daystrom Corp. where automatic handling has stepped up production 100% with no labor increase, only 35% more space, and few rejections.

25-48. Disposal of Cyanide Wastes. (Concluded.) John G. Dobson. *Metal Finishing*, v. 45, March 1947, p. 68-71.

The alkaline chlorination method for neutralization of these wastes. Methods for determining freedom of waste from cyanide. The design of plants for the neutralization and disposal process.

25-49. Progress in Engineering Knowledge During 1946. P. L. Alger, James Stokeley, J. L. Tugman, F. H. Faust, W. W. Kuyper, E. L. Robinson and W. D. Haylon. *General Electric Review*, v. 50, March 1947, p. 12-55.

Excellent survey by seven experts is extensively illustrated. Main sections on materials, design, and applications, each being subdivided into appropriate subtopics. An extensive classified bibliography.

25-50. Technical Highlights of the Western Metal Congress. *Steel*, v. 120, March 31, 1947, p. 86-87, 96, 99-100.

Wide range of subjects on steelmaking, casting, joining, heat treating, surface finishing, inspection and testing of ferrous and nonferrous materials discussed at meetings sponsored by American Society for Metals at Oakland, Calif.

25-51. Mechanical Handling in the Foundry. W. Morison Philip. *Foundry Trade Journal*, v. 81, March 6, 1947, p. 179-181; discussion, p. 181-182.

Touches on the different departments in foundries where mechanical handling has been devised, starting with the unloading of coke, pig, scrap, limestone, sand, placing this in convenient dumps, reclaiming, weighing and feeding to cupolas.

25-52. Ford Trucks Feed Heavy Stocks to Automatics. Iron Age, v. 159, April 3, 1947, p. 68.

Feeding heavy bar stock to Cone automatics directly from the electric fork lift truck used to move the stock from the storage location to the machine is a means of cutting costs through more effective utilization of industrial electrical trucks.

25-53. Handling Materials for Steelmaking. Charles M. Parker. *Iron and Steel Engineer*, v. 24, March 1947, p. 79-80.

The great amount of handling existing in the steel industry. A load of ore is followed from pit to finished product with emphasis on the number of handlings.

25-54. Electric Counterweights for Ingot Stripping Cranes. R. J. Harry. *Iron and Steel Engineer*, v. 24, March 1947, p. 105-107.

An ingenious modification of the usual circuit controlling of a stripper crane causes the hoist motor to act as an electric counterweight.

25-55. Quality Tool Steels. H. C. Bigge. *Western Machinery and Steel World*, v. 38, March 1947, p. 74-77, 92-93.

The history of the development of these steels, and techniques now used in their conversion from raw material to finished product.

25-56. Surface and Overhead Conveyers Help Speed Kitchen Stoves to Waiting Market. *Steel*, v. 120, April 7, 1947, p. 92-93.

Kalamazoo Stove & Furnace Co., Kalamazoo, Mich., spent $2,500,000 in redesigning the plant for new tools and dies, and for creating new range and furnace designs.

25-57. Smoke and Dust Control, Heating and Ventilating in the Sorel Plant. Part II. *Industrial Heating*, v. 14, March 1947, p. 422-424, 426, 428, 430, 432.

Control of foundry and forge smoke, and the ventilation of the heating furnace area.

(Turn to page 52)

EMPLOYMENT SERVICE BUREAU

The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad will be printed. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, Ohio, unless otherwise stated.

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METALLURGIST: For electrical instrument mfg. co.; 5 to 10 yr. exp. and broad point of view since problems cover a multitude of phases, both ferrous and nonferrous. Possibly some chemistry. Box 5-5.

Midwest

FOUNDRY SUPERINTENDENT: For shop employing 50 men. Production confined to stainless steel castings. Moore arc melting furnace. Prefer college trained met. engr. with practical melting exp. on stainless steel. Must be capable administrator and executive. Steel fdry. exp. desirable but not essential. Pittsburgh. Box 5-10.

PLANT METALLURGIST: For control and specifications. Good technical education. Must be cooperative and energetic. In reply, give full information about exp. and training and quote salary expected. Box 5-15.

RESEARCH ASSISTANT: Old established mfg. concern requires the services of a qualified person for assistant head in the physical lab. Applicant must have chem. eng. or met. degree and be interested in analytical and research work. Knowledge of fdry. and machine shop practices desirable. Salary commensurate with individual's qualifications. Please submit complete information in your reply, which will be treated confidentially. Box 5-20.

CHIEF METALLURGIST: For well-known cutting tool manufacturer. 10 yr. *minimum* professional exp. required, some in high speed met. Knowledge of toolsteel mill operation desirable. Responsible for heat treating specifications and quality control, steel specifications, laboratories, research, met. investigation of service failures. State age, qualifications and salary requirement. Box 5-25.

METALLURGIST: Teaching assistant working for M.S. and Ph.D., one-third, one-half or full time. Fine facilities for research. Exp. in cast metals or in welding desired, but not necessary. All replies promptly acknowledged and held in confidence. Write directly to Illinois Institute of Technology, 3300 South Federal St., Chicago 16, Ill.

METALLURGIST: Instructor or assistant professor in physical met. Excellent opportunities for research. Write to Illinois Institute of Technology, 3300 South Federal St., Chicago 16, Ill.

POSITIONS WANTED

METALLURGIST: B.S. 1935. Married. Majority of exp. in ferrous metals fabrication, physical and mechanical testing and heat treating. 2 yr. malleable iron fdry. exp.; 3 yr. research helper and quality control; 1 yr. production research. Prefers Southwest, but will consider any place with progressive co. Will travel. Box 5-35.

SALES ENGINEER: B.S. in chem. 3 yr. post grad. work in phys. met.; 6 yr. steel mill exp. including metallurgy, specification writing, physical and chem. lab. Openhearth, blast furnace, rolling mill inspection and production control (carbon and alloy flat rolled products). 4 yr. Government exp. (W.P.B. and W.A.A.). Age 36. Married. Good speaker, good personality. Prefers to travel Eastern Seaboard. Available immediately. Box 5-40.

WIRE MILL METALLURGIST: Age 39. Desires position as chief metallurgist or assistant in a progressive wire mill. Grad. in ferrous met., M.S. 12 yr. exp. in inspection, contact and development work of wire and wire products. Employed at present but available on two weeks' notice. South or Southwest preferred but would consider other locations. Box 5-45.

METALLURGIST: B.S. Age 32. 8 yr. exp. in production of cold rolled, hot rolled, galvanized, long terne sheets. Familiar with deep drawing operations and fabrication of sheets. Desires met. or production position with fabricating co. or will consider manufacturer of sheet. Ohio, Ind. or Mich. preferred. Box 5-50.

HEAT TREATING ENGINEER: Age 34. 10 yr. exp. in heat treatment field. Exp. in tool and production steels, furnace equipment and furnace atmospheres. Has done customer contact work selling, shipping, purchasing, scheduling, inspection specification writing, planning and trouble shooting Desires position in heat treating or sales engineering Prefers Chicago area or Southwest. Box 5-55

PHYSICAL METALLURGIST: D.Sc. Age 30. 6 yr. varied industrial exp., 2 yr. teaching exp. Well qualified for conducting research in various phases of physical met. Desires position with research organization or university. Box 5-60.

CHIEF METALLURGIST: Age 38, married, 4 children. Ph.D. in met. 13 yr. exp. openhearth steel manufacturing, processing and fabrication of wire, steel cartridge cases, acid electric steel castings; heat treatment and design of tools. Desires production or research, preferably Midwest. Box 5-65.

METALLURGICAL ENGINEER: Age 27, married. Ph.D. in met. 4 yr. exp. as graduate assistant in chem. and met. labs. Research on grain size of iron and carburization. Desires teaching position in met. eng. dept. or research position with opportunity for advancement. Box 5-70.

METALLURGICAL ENGINEER: B.S. Exp. in ferrous met. including control of development and research work, physical and metallographic testing of metals, development of high-temperature alloys, research in heat treatment by controlled atmospheres, fdry. and alloying, casting by the lost-wax process. Desires position with established lab. or mfg. concern, or instructorship in met. Eastern area preferred. Box 5-75.

METALLURGIST: University of Illinois grad. 3 yr. exp. in high tensile and armor steel. Good working knowledge of heat treatment, testing and metallography. Exp. in mill procedures. Complete knowledge and exp. in ferrous welding. Box 5-80.

PURCHASING OR SALES: Many years' exp. in production supervision, sales and purchasing of metal and engineering parts. Shop exp. in production of castings, forgings and steel mill products, heat treatment of alloy and carbon steels, dies and tools, inspection, material and quality control. Immediately available. Box 5-85.

CHIEF METALLURGIST: M.S. Age 35. 14 yr. exp. in ferrous and nonferrous metal fabrication. Adept in both met. and chem. leadership. Stainless and alloy steel. Specialist, author and lecturer. Excellent man to correlate laboratory results with production. Prefers Midwest. Ref. Box 5-90.

ENGINEER: Age 30, grad. mech. engr. 4½ yr. broad exp. in aircraft materials and processes consisting principally of research development, heat treatment, material selection and specifications, lubrication and fabrication of metallic aircraft parts. Any location but prefers West Coast. Box 5-95.

HIGH-CLASS MAN AVAILABLE: Metallurgist with 15 yr. exp. in quality control at leading American aircraft builder—procurement, fabrication, final inspection. Available for either sales engineering for producer or quality control for consumer of metals, where trouble-shooting ability and thorough knowledge of properties and capabilities of ferrous and nonferrous alloys are essential. Box 5-100.

FOR SALE

2 No. 105 Barkling round pot furnaces with nichrome alloy pot ½" thick by 6" I. D. by 12" deep, North American 65-1-6N proportional mixer assembly, zero governor Venturi mixer and indicating air butterfly valve. 1 No. 316-B2-1 North American turbo blower 220/3/60 AC motor with starter switch.

ELGIN NATIONAL WATCH CO.
Elgin, Illinois

METALLURGICAL ENGINEER: Age 30, married. B.S. in met. from M.I.T., M.S. in mech. eng. 7 yr. diversified exp. in ferrous and nonferrous heat treating, materials control, metallographic investigations, report and specification writing. Supervisory exp. as head of metallurgical lab. Desires responsible position in mfg. plant or research lab. Excellen references. Box 5-105.

FORGE SHOP FOREMAN OR SUPERINTENDENT: 10 yr. exp. in job shops in production and supervision of all types of forgings. Familiar with all types of forge equipment, large and small. Excellent knowledge of handling, working, heating and treating steels. Capable of instructing, supervising and assuming responsibilities. Age 30. Box 5-110.

PHYSICAL METALLURGIST: B.S. in met. eng. Age 26, married. 5 yr. exp. in fundamental and applied research of diversified nature in physical met. Ability to plan research programs. Possesses unusual mechanical aptitudes. Desires responsible position with university research program or progressive firm. Eastern location preferred. Box 5-115.

SOUTHERNERS: Veteran desires sales or service position with Southern firm. B.S. in met. eng. Married, age 28. Exp. in ferrous alloys, metallography, induction heating, carburizing, toolsteels and heat treating. Will consider position with steel producer or fabricator. Box 5-120.

METALLURGICAL SALES ENGINEER: Long exp. in sales, selection, application, heat treatment and use of tool, alloy, stainless and speciality steels in New York area. Widely known and respected. Thorough knowledge of mill and warehouse distribution methods. Happily employed, but requires greater responsibility and higher income. Box 5-125.

METALLURGIST: M.S. in met. eng. Age 26, married. 4 yr. exp. in process development and sales engineering in nonferrous and light metal field. Exp. in trouble shooting in fdry., forging, extrusion, rolling, heat treating, materials testing, quality control, radiography. Desires responsible position in Midwest or West. Box 5-130.

METALLURGICAL ENGINEER: Married, age 29. B.S. in met. eng., grad. study. 4½ yr. diversified exp. in ferrous research including ferro-alloys, electric arc and induction melting, heat treatment, slag-metal reactions and fdry. technique. Desires position as technical respresentative or research investigator. No preference in location. Box 5-135.

METALLURGIST: B.S. in met. 6 yr. exp. in zinc base alloy research—thermal analysis, melting, casting, annealing, metallography, corrosion, atomized powders. 4 yr. iron and steel—metallography, heat treatment, physical testing. Officer in U.S. Navy. Worked on metallography, soldering, corrosion, testing of aluminum and its alloys. Will accept position in research, production and sales. Box 5-140.

NEW YORK EVENING SESSION: Science undergrad. seeks permanent position offering intellectual, financial opportunity. Will travel (prefers Eastern Seaboard). Young woman with 4 yr. varied responsible exp. in applied engineering fields. Will consider any field, capacity, salary, opportunity. Strong wholesome personality and character traits. References. Box 5-145.

ENGINEER: Desires permanent position in sales or met. trouble shooting. B.S. in mech. eng. with teaching exp. in physical metallurgy and metallography. 2 yr. general lab. exp.; 3 yr. in large job shop, trouble shooting, mostly met. Several years private business. Available after July 1. Box 5-150.

PATENT ATTORNEY OR AGENT: B.S. in met. eng., Carnegie Tech., and 1 yr. law school. 10 yr. exp. embracing plant, lab., engineering and college teaching (chem. and met.). Good personality, able speaker and writer. Seeks opportunity in patent firm. Will complete law at night. Moderate salary, location immaterial. Box 5-155.

SALES ENGINEER: Member of A.S.M. for 28 yr. B.S. in met. and chem. eng. Desires to represent a progressive manufacturer or jobber in Cleveland or northern Ohio. Available now. Box 5-160.

CHIEF METALLURGIST: 22 yr. experience as chief metallurgist and director of research of steelmaking companies. Wartime exp. in aluminum alloy production. Desires position with iron and steel or allied industry. Box 5-165.

CONSULTANT: In Detroit area. Specializing in chemical analysis, foundry, machine heat treating and general investigations, chiefly in the nonferrous metals. Box 5-170.

25-58. Metallurgical Progress and the Plastics Industry. L. Sanderson. *British Plastics*, v. 19, Feb. 1947, p. 85-87.

Recent developments in welding; wet-belt machining; salvage sorting of aluminum bronze from manganese bronze; low-melting alloys; heat resistant and high temperature alloys; all-steel electric motors; cutting coolants; porcelain coatings for steel; aluminum plastic laminates; and other miscellaneous developments.

25-59. Man-Hour Output Raised by Mechanized Parts Handling. *Production Engineering & Management*, v. 19, April 1947, p. 66-74.

Use of conveyers in die casting, forming, plating, and finishing operations at Brown-Lipe-Chapin Division of the General Motors Corp., Syracuse, N. Y.

25-60. Handling in the Automotive Industry. N. M. Loney. *Flow*, v. 2, April 1947, p. 43-45.

Director of works engineering, Fisher Body Division, General Motors Corp., discusses materials handling developments.

26 STATISTICS

26-55. South African Iron and Steel. *British Steelmaker*, v. 13, March 1947, p. 126-134.

A history of the industry; availability of raw materials; tariff protection of industry; expansion; supply and demand; prices; the future prospects. (Reprinted from *Monthly Statistical Bulletin of the British Iron and Steel Federation.*)

26-56. Some Aspects of U.S. Mineral Self-Sufficiency. E. Willard Miller. *Mineral Industries*, v. 16, March 1947, p. 1-3.

The degree to which this country is able to meet its needs in power minerals (coal and petroleum), iron, nonferrous metals, and light metals. The need for a sound mineral policy.

26-57. The Nonferrous Metal Industry of the West. Nathaniel H. Engle. *Western Metals*, v. 5, March 1947, p. 32-35.

Analysis of light metals, gold, silver, copper, lead, and zinc; outlook by states.

26-58. Senate Small Business Committee Report on the Future of Light Metals Industry. *Modern Metals*, v. 3, March 1947, p. 28-30.

Summary of a 111-page report entitled "Future of Light Metals and Government Plant Disposals." Many ready references for those endeavoring to analyze the future of this industry. Several portions of the report, which deal with monopoly and Government controls, are controversial.

26-59. The Outlook of Zinc. W. G. Woolf. *Western Miner*, v. 20, March 1947, p. 60, 62, 64.

Economic prospects, especially in Canada. Information concerning the outlook of iron and steel, aluminum, copper, and lead.

26-60. Electric Steel in the United States at Forty-One. Clarence G. [illegible]. *Electrochemical Society Preprint 91-14*. 1947. 6 p.

Status of the industry 41 years after beginning. Manufacture of large ingots for ordnance both here and abroad. Some of the demands placed on electric furnace steel both during the war and today.

26-61. Mineral Strength of U. S. Discussed by A.I.M.E. *Chemical and Engineering News*, v. 25, April 7, 1947, p. 966-967.

Addresses given at World Conference on Mineral Resources.

26-62. India's Mineral Policy Keyed to Nationalism. Michael D. Lyons. *Engineering and Mining Journal*, v. 148, April 1947, p. 83-85.

Present conditions and new policies emerging as a result of Indian independence.

26-63. What to Do About Our Iron Ore Reserves. Charles F. Park, Jr. *Mining and Metallurgy*, v. 28, April 1947, p. 192-196.

Why some poor ores are being used while good ores of the world are untapped. Need of conserving and further exploring in this country to obtain additional resources before iron ore shortages become a problem.

26-64. Allies Differ on Levels of German Metalworking Output. John Christie. *American Machinist*, v. 91, April 24, 1947, p. 117-120.

Indicates the scope of problems which must be ironed out by the Big Four before equitable reparations can be agreed upon.

For additional annotations indexed in other sections, see:
1-45; **15**-14; **27**-74.

27 NEW BOOKS

27-67. A Treatise on Milling and Milling Machines. Section 2. 326 p. The Cincinnati Milling Machine Co., Marburg & Klein St., Cincinnati, Ohio. $1.00.

Fundamental concepts of milling, including cutting speed, feed per tooth, amount of work material removed, chip formation, surface finish, cutting fluids.

27-68. Proceedings of the Second Industrial Waste Conference. 183 p. Jan. 10-11, 1946. Department of Engineering Extension, Purdue University, Lafayette, Indiana. (Extension Series No. 60.) Gratis.

A series of papers and discussions on waste disposal and utilization. Types of wastes discussed included: food wastes, waste pickling liquors, brewery wastes, metal-plating wastes, oil-refinery wastes, paper-manufacturing wastes, sewage, and miscellaneous industrial wastes.

27-69. Chemical Crystallography. C. W. Bunn. 422 p. Oxford University Press, Oxford, England. $7.50.

Methods which have been developed for identification of solid substances by microscopic or X-ray methods and for determination of precise atomic positions in crystals. No previous knowledge of crystallography is assumed. An account of the elements of crystal morphology and optics, the interpretation of various types of X-ray diffraction photographs, and the location of atoms both by the trial-and-error method and by Fourier-series methods.

27-70. Aluminum Surface Finishes. 80 p. Aluminum Co. of Canada, Ltd., Montreal, Canada. Gratis.

Practical information about the various chemical, electrochemical, and mechanical finishing techniques. The use of paints, enamels, lacquers, and varnishes.

27-71. Carborundum Grinding Bulletins. 108 p. Carborundum Co., Ltd., Trafford Park, Manchester, England.

The Carborundum Co. has issued in bound form 25 different bulletins which have been published since 1942, and which give instructive information on the economical use of abrasives in industry. This contains a vast amount of information which can be usefully applied in the workshop with such items as wheel balancing, truing grinding wheels with diamond tools and nondiamond tools, and similar subjects. Owing to the extremely short supply, the distribution of these bulletins is limited to bona fide technical establishments, training colleges, and the like. (From review in *Industrial Diamond Review*, v. 7, March 1947.)

27-72. Cutting Tools for Engineers. Revised Edition. A. H. Sandy. 130 p. Crosby, Lockwood and Son, Ltd., London, England. 5s.

General considerations, the mechanics of metal cutting, and tool materials. Modern practice as applied to hand tools, drills, lathe tools, milling cutters, broaches, and gear-cutting tools. Tool and cutter grinding, and cutting lubricants.

27-73. A.S.T.M. Specifications for Steel Piping Materials. 307 p. Dec. 1946. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. $3.00.

Requirements of materials such as castings, forgings, bolting materials, and nuts used in piping installations; specifications for steel piping materials. Standards are given for valve, flange, and fitting castings, and also for carbon and alloy steel bolting. Specifications for forgings and welded fittings are included.

27-74. Light Metals Monopoly. C. F. Muller. 279 p. Columbia University Press, 2960 Broadway, New York 27, N. Y. $3.00.

Based on two antitrust cases in aluminum (1937-1945) and magnesium (1941-1942), an economic study of the position held by the Aluminum Co. of America shows how important monopolies have developed and describes their effect on the production and development of light metals. Three factors are emphasized: control of power sources; international cartel relations; and control of a substitute, magnesium. The relation of government policy to monopolies is examined, and alternatives are suggested to cope with the basic economic problem. (From review in *Electrical Engineering*, v. 66, April 1947.)

27-75. The Problem of Fracture. John H. Hollomon. 92 p. American Welding Society, 33 West 39th Street, New York 18, N. Y. $1.00.

This monograph is the result of a survey of available information sponsored by the Welding Research Council of the American Welding Society. The author has attempted to interpret the knowledge of fracture in terms of consistent theory. Where there are divergencies in knowledge, they are pointed out, and where theory is inadequate, an attempt is made to indicate the direction of research to resolve the difficulty. The analysis does not necessarily represent the accepted interpretation of fracture, but is often a reflection of the author's point of view. 126 ref.

27-76. Metallizing Nonconductors. S. Wein. 62 p. Metal Industry Publishing Co., 11 W. 42nd St., New York, N. Y. $2.00.

Methods of metallizing, or deposition by plating, of metals on nonconductors. A historical review of the subject and extensive patent listings. Formulas and procedures.

27-77. Transactions of the American Foundrymen's Association. 421 p. American Foundrymen's Association, 222 West Adams St., Chicago 6, Ill. $4.00 to members and $15.00 to nonmembers.

Sixty-five papers prepared for presentation at the 1945 annual convention of the American Foundrymen's Assoc. Papers cover a wide range of topics relating to the various branches of the foundry industry and deal with sand, radiography, patterns, welding, wage incentives, precision casting, matchplates, refractories, safety and hygiene, melting, reduction of microporosity in magnesium castings.

27-78. Specifications and Tests for Electrodeposited Metallic Coatings. 46 p. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. $1.25.

Compilation of standard specifications and tests for electrodeposited

(Turn to page 54)

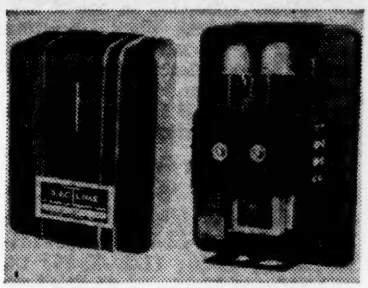
NEW PRODUCTS IN REVIEW

TEMPERATURE CONTROL

A unit called the Xactline overcomes the difficulty of thermal lag in the thermocouple (and protecting tube) and mechanical lag in the pyrometer. This instrument is connected into the thermocouple circuit of any controlling pyrometer, either millivoltmeter or potentiometer type. Depending upon relation of pyrometer setting to actual furnace temperature, a small millivoltage is either added to or subtracted from the millivoltage developed by the furnace thermocouple.

On the heating half of the cycle, the millivoltage is additive, which causes the pyrometer to shut off the heat source shortly before the actual desired temperature has been reached (as shown by the furnace thermocouple with its lag). Once the heating source has been shut off, the Xactline puts a negative millivoltage into the thermocouple circuit, causing the pyrometer to turn heat on shortly before it would normally. The net result of this action is an "anticipation" of furnace or process temperature requirements, giving very close "straightline" temperatures.

A small laboratory furnace of a popular make designed for a maximum of 2000° F. has been controlled at 400° F. with a temperature variation of ±1° F. At this temperature, the furnace cycle was approximately 2 sec. on



and 15 sec. off. The closer the control point is to the normal operating range of the furnace, the closer is the degree of control available. Operating this furnace at about 1500°, the variation from set temperature is less than ± ☆° F.

CLAUD S. GORDON CO.,
3000 S. Wallace St.,
Chicago 16, Ill.
Mention R-520 for Reader Service

POWDER METALS PRESS

To meet the demand for greater pressures and higher production in compacting a wide range of powdered metals parts, the F. J. Stokes Machine Co. is offering an S-3 can-type press of 40 tons capacity, to operate at speeds up to 30 strokes per min.

This press is a fully automatic machine in which independent cams control the synchronized movements of both upper and lower punches. The compound lower punch is designed to operate either as a secondary lower punch or as a movable core rod. This mechanism can also be locked in place to serve as a stationary core rod. The die table can take the full pressure applied by the upper punch, a useful feature in the manufacture of shouldered bushings or similar pieces. The upper punch is timed to stay out of the way during more than 110° of the cycle before descending rapidly and then slowly compressing the metal powder. This feature facilitates the feeding of difficult materials; it is essential in making parts with thin walls in which feeding is a particularly difficult problem. The cams have hardened blocks at the pressure points and can be set to control each punch movement within a wide range.

The maximum die fill is 6¼ in. and the maximum diameter of piece that can be pressed is 3 in. The press is unusually rugged, to minimize deflection and assure accuracy and uniformity in formed parts even when operated under very heavy overloads.

F. J. STOKES MACHINE CO.,
Philadelphia 20, Pa.
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Use this convenient method to obtain further information on items of interest to you in METALS REVIEW. The following numbers refer to the new products and manufacturers' literature in this issue.

Metals Review, May 1947

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MAIL TO METALS REVIEW, 7301 EUCLID AVE., CLEVELAND 3, OHIO

metallic coatings issued under the joint sponsorship of the A.S.T.M. and the American Electroplaters' Society.

27-79. Resistance Welding Manual. Revised Edition. 552 p. Resistance Welder Manufacturers' Assoc., 505 Arch St., Philadelphia, Pa. $3.00.

Contains 20 entirely new chapters, as well as revisions of previously published chapters. Each group of metals is treated in a separate chapter. Mechanical and electrical characteristics of both a.c. and stored energy systems are treated in detail. New section contains chapters on quality control, standard tests, and instrumentation. Results of important research studies are presented in abstract form in appropriate sections.

27-80. Acid Electric Furnace Steelmaking Practice. Conrad C. Wissmann. 84 p. 1947. American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. $1.00.

This booklet presents a simple set of instructions primarily as an aid to those who are engaged in the operation of acid electric steel-melting furnaces. Confined to operating problems.

27-81. The Iron Age Welding Manual. Edition 1. 172 p. Iron Age, 100 East 42nd St. New York, N. Y.

Many tables, diagrams, and illustrations. However, the bulk of the material is in the form of chapters on different aspects of welding by experts in the respective fields. These are arranged in four sections: arc, resistance, gas, and pressure welding.

27-82. 10,000 Trade Names. Edition 1. T. W. Lippert. 112 p. Iron Age, 100 East 42nd St., New York, N. Y. Reprinted from *Iron Age*, Jan. 2 through March 6, 1947, issues.

Alphabetical index of all American and foreign ferrous and nonferrous metals and alloys, plastics, nonmetals, refractories, cements, lubricants, chemicals, plywoods, machine tools, small tools, rolling mills, cranes, bearings, joining devices and other equipment made and used by the metals industry; processes, proprietary and otherwise, in the production, shaping, treating and finishing of metals. Each item is described briefly, and the manufacturer's name and address are given.

27-83. Symposium on Testing of Bearings. 72 p. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa. $1.50.

Five technical papers presented at the 49th Annual Meeting of the American Society for Testing Materials at Buffalo, June 24-28, 1946. They include life testing of plain bearings for automotive engines, fatigue testing machines for ball and roller bearings, metallographic observation of ball-bearing fatigue phenomena, and testing of bearings under controlled loads.

27-84. The Development of Monolithic Dolomite Linings. 253 p. 1946. The Iron and Steel Institute, 43 Grosvenor Gardens, London, S.W.1, England. (Special Report No. 33.)

Six sections by different authors give details of the results of cooperative wartime research in Britain. Results of a fundamental study of dolomite and its fabrication into dolomite refractories and furnace lining materials; use of tar as a bonding material; work on the development of satisfactory technique for lining and maintenance of different types of furnaces; and results of experiences with commercial electric furnaces, openhearths and bessemer converters, lined with dolomite.

27-85. First Report of the Rolling Mill Research Subcommittee of The Iron and Steel Industrial Research Council. 146 p. 1946. The Iron and Steel Institute, 4 Grosvenor Gardens, London, S.W.1, England. (Special Report No. 34.)

Extensive report consists of five sections by different authors: an introduction; a critical literature survey (184 ref.); a detailed illustrated description of an experimental cold rolling mill recently rebuilt at Sheffield University; a description of an improved instrument developed for measuring roll force, including a discussion of previously used methods; and a description of a simple method for calculating roll pressure and power consumption in hot flat rolling.

27-86. Second Report on the Development of Monolithic Dolomite Linings. 140 p. 1946. The Iron and Steel Institute, 4 Grosvenor Gardens, London, S.W.1, England. (Special Report No. 35.)

Another extensive report on dolomite linings. Subjects investigated in separate papers by different authors include: properties of fettling materials; tar-bonding; correlation of pan-mill data; fettling of openhearth furnaces; factors affecting hearth life; dolomite doors and wing walls; taphole construction and maintenance; factors affecting consumption of dolomite in openhearth furnaces; utilization of dolomite in electric furnaces, bessemer converters, and mixer ladles.

27-87. Wear of Metals. D. Landau. 85 p. Nitralloy Corp., New York, N. Y.

The second edition of a useful brochure on wear. 66 ref.

27-88. Carboloy Die Service Manual. 64 p. Carboloy Co. Inc., Detroit, Mich.

Service manual on the necessary maintenance operations for small and large dies, as well as special shaped dies. Great emphasis is laid on the correct die shape, and nomographs are appended for their determination. Several grades of diamond powder are referred to, but no data on the grain size is given. Shaped and rough diamond tools for the blending of radii and boring the die channel are mentioned. An illustrated list of necessary machines and special tools is given, as well as the layout of an up-to-date die maintenance plant.

FURNACE FOR SALE

Surface Combustion Gas Fired, Char Mo atmosphere furnace Cat. No. C.H.S. 12-22. New installation of muffle and parts. Good condition. Temp. Range 2000 to 2400° F. Outside measure 45" wide x 46" deep x 42" high. Door 15½" x 14½" air operated.

Massachusetts Steel Treating Corporation
118 Harding St., Worcester, Mass.

MATERIALS INDEX

The following tabulation classifies the articles annotated in the A.S.M. Review of Current Metal Literature according to the metal or alloy concerned. The articles are designated by section and number. The section number appears in bold face type and the number of the article in light face.

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Cast Iron

3-94-105-114; **4**-46; **7**-150; **10**-63; **11**-36-44; **14**-94-95; **20**-165-190-199; **23**-121.

Cast Steel

2-63-72; **3**-105; **10**-63; **14**-95-96-97; **20**-160-165-190-214; **22**-186.

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4-47; **6**-63; **7**-105-111-129-137; **18**-74; **19**-119; **20**-165-190-196; **22**-167-219; **23**-123; **24**-111-118; **27**-73.

Alloy Steel

2-72; **3**-88-91-93-95-107-110; **4**-39; **7**-127; **9**-40-48; **10**-57; **12**-66; **18**-62-71-72-83; **22**-167; **23**-92-111; **24**-112; **26**-60; **27**-73.

Stainless and Heat Resisting Steel

3-104-105-111; **4**-44; **6**-59; **7**-111; **11**-32; **19**-89; **20**-214; **22**-160-162-168-214-216-218; **23**-91-104-107; **24**-97-117; **26**-60.

Toolsteel and Carbides

3-113; **9**-43; **18**-71-72-73-81; **20**-161-163-166-185-187-197-198; **23**-115; **24**-96-98; **25**-55; **26**-60; **27**-72-88.

Ferro-Alloys

10-57; **16**-47.

General Nonferrous

2-62; **3**-88; **8**-57-58; **10**-66; **14**-102; **16**-44-51; **19**-94-107; **25**-46-50; **26**-57.

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2-71; **3**-100-106; **4**-38-42; **6**-55; **7**-106-117-119-128-129-135-136-137; **8**-43; **9**-41; **10**-58-61; **11**-31-38-45; **12**-62; **14**-90-103-112; **15**-12; **18**-63-81; **19**-96-98-105-111-113; **22**-170-171-179-205-220-221; **23**-94-95-96-97-98-99-101-114-118-119; **24**-105; **26**-58-59; **27**-70-74.

Magnesium

2-56-74; **3**-92-96; **6**-62-71; **7**-107-129-132-135-136-137; **11**-33; **14**-91-98; **19**-92-105-114-118; **22**-179; **23**-98-103; **26**-58; **27**-74.

Copper, Brass and Bronze

1-46-50; **4**-42; **5**-23; **6**-58; **7**-110; **8**-47-56; **10**-58-63; **12**-71; **14**-107; **15**-12; **22**-192-200; **26**-59.

Nickel and Nickel Alloys

6-59; **8**-45-46-47-49-51; **10**-64; **13**-9-17; **19**-100.

Lead and Lead Alloys

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Tin and Tin Alloys

3-102; **4**-43; **7**-114-139-140; **8**-50-54.

Zinc and Zinc Alloys

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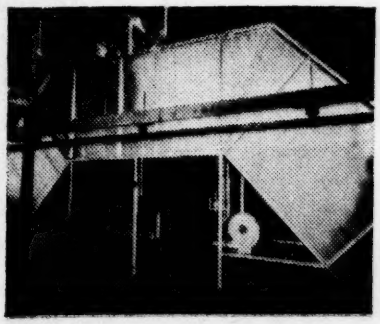
NEW PRODUCTS IN REVIEW

RUSTPROOFING, INFRARED

New Burdett burn-off rustproofing process not only removes grease and similar films but simultaneously produces a blue surface on the metal that is extremely rust resistant. The blue coating is in the form of a tight scale that reaches all deep and hidden re-



cesses of the surface. The process utilizes gas-fired infrared burners properly placed in relation to the work.

In an important installation in a Minnesota plant, the infrared burn-off oven replaced an alkali wash, two rinse tanks, a bonderizing tank and an acid bath. The plant manufactures greasing equipment for automobile service stations and garages, where a high quality finish is essential to resist the constant ravages of water, gasoline, oils and grease.

In the new process degreasing and rustproofing are done simultaneously with a noteworthy saving in time, labor and equipment. The entire operation averages 5 min.

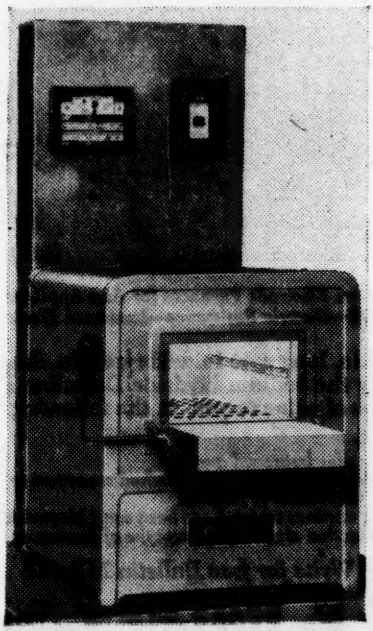
Sheets treated by this process have been tested under severe weather conditions for as long as five weeks without indication of rust. Tests in acid atmosphere have shown similar results. Paint adhesion is said to be equal or superior to adhesion on surfaces treated with commercial liquid rust preventives.

BURDETT MFG. CO.
3433 West Madison St.
Chicago, Ill.
Mention R-522 for Reader Service

FURNACES, RECIRCULATING AIR DRAW

Two new furnaces of the recirculating air draw type are the Model ACL, for temperatures to 900° F., and the Model ACH, for operation up to 1200°. Both furnaces provide the accuracy and uniformity required in all low-temperature heat treating operations. They may be used for tempering or drawing of both carbon and high speed steels, and for nonferrous heat treating. They are ideal for tool and die tempering.

A temperature uniformity of +5° and —0° can be obtained. Simple temperature control is effected by the new Cooley selective power modifier, built



into both furnaces, and operating with an indicating pyrometer. The modifier corrects temperature lag behind the pyrometer reading, characteristic in electric furnaces and substantial when operating below 1200° F. Overshooting of the pyrometer is eliminated.

Heating elements are placed behind vertical baffles at either side of the furnace chamber. An impeller-type fan, mounted below the perforated cast metal hearth plate, forces air up between the baffles and the heating units. The air then circulates down through the work and back to the fan in a steady flow. Heating elements are of the standard Cooley high-temperature embedded type.

The power input of both furnaces is 4 kw. at 230 volts. The furnace chambers are 10 in. wide, 6 in. high and 14 in. deep. Either furnace will accommodate 50 lb. of parts.

COOLEY ELECTRIC MFG. CORP.
Indianapolis, Ind.
Mention R-523 for Reader Service

ELECTRODE, WELDING

New electrode for automatic arc welding is known as Raco composite type A—a heavily coated electrode in coils, providing the same physical results as heavily coated manual electrodes. Extremely high speeds can be obtained in any position. It can be used with all standard automatic arc welding heads without alterations or additions.

The electrode may be had with any of the following coatings—A.W.S. 6012, 6020, 6030, 7020, 7030, 8020, 8030, 9020, 9030, 10020 and 10030; also in three grades of hard surfacing material, namely, Raco 25 (Rockwell C-20 to 25); Raco 45 (Rockwell C-40 to 50); and Raco 55 (Rockwell C-50 to 60). It is furnished in the following sizes: No. 6, approximately ¼ in.; No. 5, approximately 7/32 in.; No. 4, approximately 3/16 in. and No. 3, approximately 5/32 in. Coils are 36 in. i.d., and weight is 150 to 200 lb.

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Metals that are difficult to draw such as semihard alloy steels, tempered brass, or magnesium, can now be successfully embossed with raised or sunk lettering or design by using Acroboss dies. These embossing dies are so made as to raise the characters without creating cracks or breaks in the metal.

In containers or metal parts to be used as cups, cans and covers, it is usually important that the final embossing be free of fracture so as to prohibit even the penetration of fine oil or noncorrosive liquid chemicals. Vari-angle engraving, a new development by Acromark permits such embossing results.

THE ACROMARK CO.,
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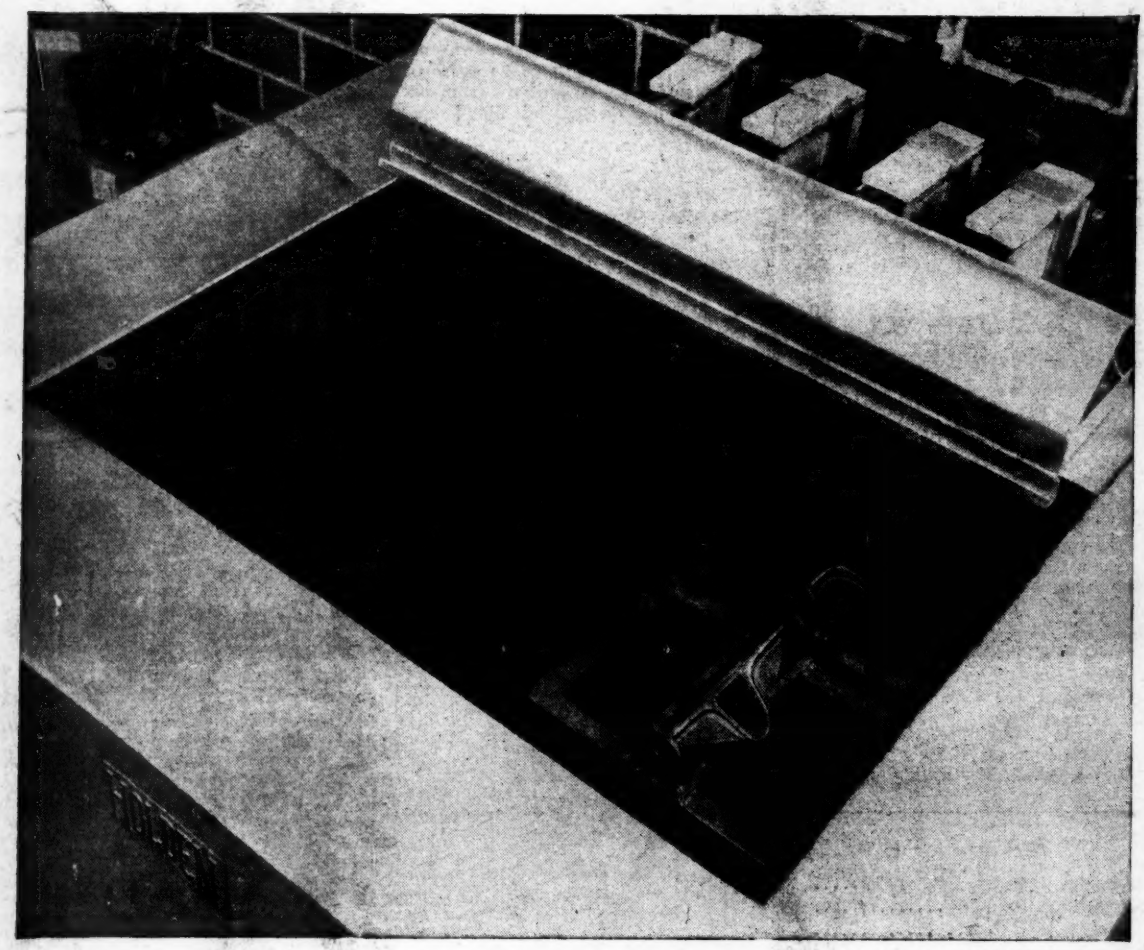

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